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Sand Blasted Glass Decoration

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GLASS frosting my means of sand blasting was discovered by the American, Tilghman, about 1870. He observed with apprehension that the windows of his dwelling in the prairies began to tarnish under the influence of draughts of air laden with sand. In order to protect his windows, he covered them with a metallic netting to find after some time, instead of being entirely roughened, that the glass presented the design of the metallic netting; the glass immediately behind the netting having remained transparent while elsewhere the particles of sand had accomplished their work and roughened the glass.

After this observation, Tilghman tried to apply industrially the destructive action of sand and about 1880, he entrusted the Gutmann concern at Altona, to exploit and develop his invention.

The phenomenon of frosting glass exposed to a sand blast is caused by the corrosive action exercised by the grains when they are projected with a certain force against any obstacle.

The speed wherewith this obstacle will be destroyed under the action of the particles acting as thousands of small hammers, will thus depend from four factors:

(1) from its composition and resistance;
(2) from the sand;
(3) the size of the grains;
(4) from the duration of the work.

From the observance of the mutual relations existing between these working factors, the various possibilities are appreciated and especially the various means of applications of the sand blast work that are proffered.

THE SAND BLASTING MATERIAL

(a) The Glass: We will dwell here on the working of glass only. It thus follows that the nature and composition of the glassy mass are the directing factors to determine the resistance as regards the corrosive action of sand. Generally speaking, it may be said that the technical hardness of glass only presents a secondary importance as far as the sanding work is concerned. The prolonged theoretical exposure for superior hardness is small, owing to the violence of the blast whereof the intensity may further be regulated.

The second matter having to undergo the corrosive results from sand is the protective coating used to preserve certain places of the object and in this way to reproduce upon it the desired motive, as of old the windows of Tilghman received the design deriving from the metallic netting.

(b) The Protective Coatings: In consideration of the fact that the sand blast succeeds in not only destroying, in a few seconds a layer of glass fairly deep in bringing about a complete grinding, but even eliminates a glassy mass of several millimetres, the question of a protective coating sufficiently resisting is a problem of first importance. Now, substances such as glass, marble, iron, etc., only present a mean resistance to the shocks exercised by the particles of sand projected and as hammer blows against a wall, makes the material burst hither and thither. On the other hand, the same blows carried out on a sheet of cardboard, lead, rubber, etc., yield no result; they leave at most an imprint where the hammer has been rejected. This explains the reason why glass is destroyed and that metals cannot protect it, while the paper or lead sheets may, by their elasticity of substance, suffer the sand blast action during a much longer period, without deteriorating. The former reject the grains but suffer at the same time a loss of their mass, while the soft materials reject them though they become crushed or allow themselves to be compressed as the result of the blast.

The protection of glass may thus be effected in three manners:

(a) by metallic stencils: These are merely made from a lead sheet from ½ to 2 millimeters thick, wherein the design to be reproduced has been cut out. Under certain circumstances, i. e. for window glass, zinc sheets may be used also.

(b) by elastic stencils: Under this heading, paper or rubber stencils may be quoted.

(c) by resisting coatings: In the present time of mass production, the problem of a high turnout has been more and more substituted to artistical initiative; the resisting coatings are more often employed. They are chiefly used for

mass production purposes, such as inscription engraving, designs and motives on bottles, advertising glass plates, in the drinking glass manufacture, and so forth.

The coatings are varnishes that may quickly be applied to the article and when they are dried, they possess a sufficiently great resistance to preserve glass from sand corrosion. They may be of varied compositions, such as for instance a mixture of 50 units of liquid glue with 30 grams of glycerine and an addition of about 140 grams of talcum powder.

SAND

The composition of the sand presents no difficulty, the main condition being that it must be dry and pure. As to the quality and sizes of the particles, it is difficult to make a selection. The corrosiveness of the sand is best determined by a few tests. As a general rule, sand with large particles will turn out a rougher frosting than the grains of great

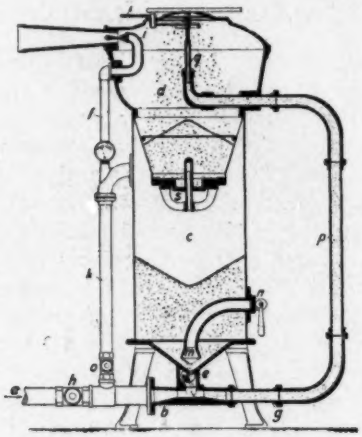

FIG. 1. AIR PRESSURE MACHINE

thinness, but have a very sharp cutting property. On the other hand, fine sand yields a more beautiful engraving and grounding, but the work will take longer.

DURATION OF THE WORK

It has been seen that glass and sand are two elements whereof the qualities may only be selected in a very relative measure. Consequently, the relation between the two factors is expressed in the rapidity of the work, i.e., the time needed to secure on the glass an engraving of a determined intensity. The workman must thus adapt his machine to the proper speed by regulating the duration of sand ejection, by a motion more or less quick of the carriage, or a rotation more or less active of the disc.

The fineness of the frosting may be regulated to a certain extent by varying the outlet of sand and consequently its corrosive effect.

This means that sand grounding work necessitates an indisputable skill and the decorative effect of an engraving depends to a certain extent on individual initiative.

Decorative Work

The decorative work even in the form of engravings, motives and designs, is entirely based on the minute and well chosen applications of the stencils in accordance with the model and design of objects required.

Consequently, a series of different shades must chiefly enhance the design to its full extent. The designer of a panel ground by sand blasting, begins to sketch the motive in the required size and indicates by numbers the various shades. When the sketch is completed, it is counterdrawn on a sheet of paper or lead. From this copy, the stencils are made, taking care to turn out as many copies as there are shades, beginning with the most marked shades, plus one series to cover the portions to remain free from grinding.

The glass and stencils are exposed to the sand blast as many times as there are series of stencils, each time placed in such manner that the portions to undergo a marked frosting, be several times exposed.

The application and selection of a protective coating are effected according to the style of decoration and the objects to decorate. The metallic stencils are specially employed for flat glasses. For hollow glass, the sheet is folded and wrapped round the article. However, it is indispensable that it strongly presses on the required spot so that the grounding should show very clean edges. To this end it is generally necessary to affix the stencil by means of a special adhesive coating. The elastic stencils, either of smooth paper or rubber must also be attached. The designs are then cut out.

In the majority of cases, resisting coatings are used in the same manner. They are spread out by means of a spatula or paint brush on the parts where grinding is not required, according to a design cut out in a zinc stencil placed on the object to be treated. Instead of using a stencil, the coating representing, thus, the transparent motive, may be applied by imprint. The coating is powdered with a little talcum powder and quickly hardens enough to undergo the treatment. For certain deep engravings on two layer or single-layer glasses, the reproduction of the design is carried out by applying on the glass a thick mass of special paper. The latter almost takes the form of a mask. As the sand blast gradually meets a layer of paper of another resistance, the proportions of shades on the glass become modified. By this process the series of stencils are thus eliminated and the operator has merely to attend to a regular frosting process.

To make holes in glass by means of sand blasting, a sheet-iron stencil having proper size holes is sufficient, but it must be strongly attached to the glass surface.

Sand Blasting Machinery

The machines for operating sand blasting derive the necessary force of blast by means of a draught of air due to pressure. The air pressure may be brought about in two manners: either by an air compressor or by the formation of a vacuum leading to a violent draught that carries away the sand.

The sand blasting machines may be divided into two classes:

(a) by pressure;
(b) by air vacuum.

As regards the machines operating with pressure, three systems may be taken into account:

(1) the air pressure machine,
(2) the air suction machine,
(3) the steam pressure machine.

PRESSURE MACHINES

Suction Machines: The suction system is based on the principle of the flower atomizers. A draught of air is sent under pressure through a piping which brings about a vacuum of air before the channel carrying the sand. This causes a secondary draught of air which brings the sand into the primary draught of air, which in its turn ejects the sand against the article to be treated. The sand blast is effected vertically against the article to be treated which is held before the opening on which a stencil has been placed. This type of machine is particularly adapted for mass production and the operator has but to hold the object before the opening for a few seconds. In order to protect the article from dust, the apparatus may be surmounted by a stack fitted with a small window and opening formed of leather, in order to enable the operator to follow the process, to withdraw and to handle the articles during the treatment. The turnout of this type of machine may be from 150 to 200 engravings per hour or from 5 to 6 square metres of frosted glass.

For the sand blasting of large articles, such as marble plates for advertisements or cemetery decoration, free blast apparatuses are employed. In this case the operator wearing a protective helmet blasts the sand directly on the article to be treated, by means of an ejector. The operation must be carried out either in the open air or in a special structure. The ejecting air pressure does not normally exceed 1½ to 2

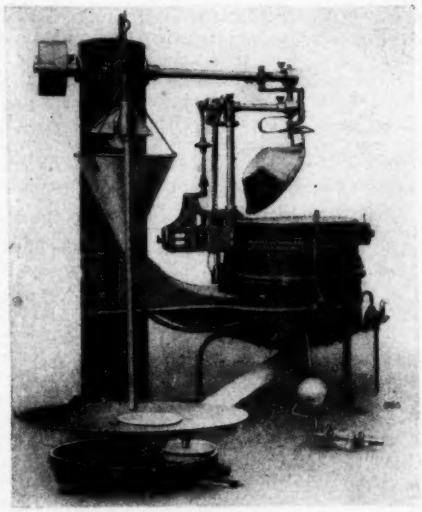

FIG. 2. STEAM BLASTING MACHINE

atmospheres and the turnout is to a certain extent, below that of the previously mentioned type. It is chiefly the skill of the operator which plays the greatest part.

Air Pressure Machines: For treatments necessitating a very marked frosting and a deep engraving, namely to bore holes in glass sheets, it is preferable to employ a special type of machine operating under direct air pressure, whereof the action is much more powerful. In such cases the sand falls directly in the channel carrying the air under pressure. In appearance, the apparatus is much like the preceding type. The sand used and having been ejected against the article to be treated, falls into a recipient placed above the sand tank. Now and then, a ventilator opens in the lower portion of the recipient and the sand enters the circuit again.

The turnout amounts to 600 to 800 letters or from 5 to 8 square metres of frosted glass for an ejector of 10 millimeters.

To drill holes, the turnout depends upon the thickness of the glass used. Normally it may be estimated as the duration of treatment for glass of 8 millimeters thickness, from 12 to 45 seconds to drill holes from 8 to 50 millimeters in diameter. For glass 3 millimeters thick, 8 to 35 seconds for holes of 8 to 50 millimeters.

Steam Blasting Machines: When a very fine frosting is required or a large output, the air is substituted by a steam blast of 4 to 5 atmospheres. The principle of operation is about identical to the one brought about by the air pressure machines; the motor is however substituted by

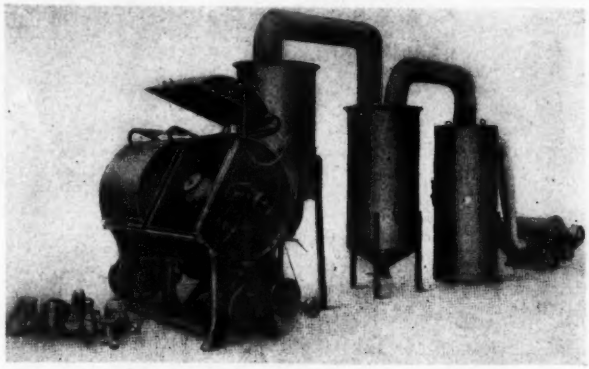

FIG. 3. AUTOMATIC AIR VACUUM MACHINE FOR HOLLOW GLASSES

an appropriate boiler. The straight ejection of steam on the articles to be decorated, presents however, the danger of cracking the glass and to damage the paper stencils. To eliminate this inconvenience, it is necessary to insert between the boiler and the ejector, an apparatus sending forth a cold draught of air in opposite direction to the steam and sand blast. In this way, the steam becomes condensed and reduces in the first place the temperature of sand and does away with the former. This new system of Mathewson, applying wet sand even muddy, proffers another advantage. The fineness of the sand frosting is limited to the size of the sand particles; if the latter is in a powdery form, it does not flow sufficiently and stops the apertures of the pipes. Moreover in a muddy form sand may be used without danger and secure very fine results and engravings, which are not easily distinguished from those obtained by the acid engraving and grounding methods. It is to be taken into consideration that the types of machinery described above, may profitably be availed of for factories of average importance. However, for a large turnout the semi-automatic operation work is not advocated and it is a question of substituting hand labor by machines, whereby the article to be treated, undergoes automatically a back and forward motion and whereby again the rotation enables a uniform frosting

of all sides. This movement is interrupted by a special device, when the lid of the apparatus is opened to take out the pieces. An automatic steam pressure machine may turn out 80 to 90 vases of 150 millimeters diameter, with a steam construction of 100 to 150 kilos.

AIR VACUUM MACHINES

This system is particularly used for the decoration of flat glass and sometimes for hollow glass when steam is not available. In the first case, the glass sheets are laid on a table provided with a table cover, then they are seized by some rubber rollers and automatically move towards the transverse slit delivering the sand. This slit possessing a length of from 75 to 135 c/m; its width may be regulated at will.

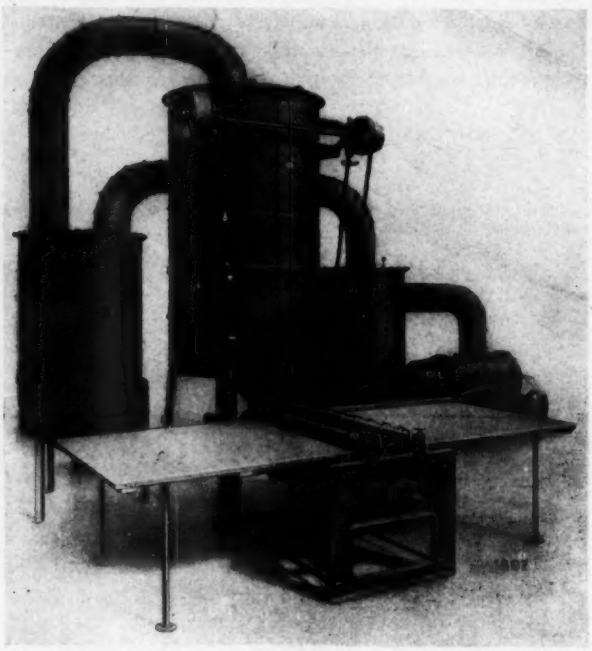

FIG. 4. AUTOMATIC AIR VACUUM MACHINE FOR FLAT GLASSES

The sand projecting apparatus itself operates according to the following principle: an air suction device forms an air vacuum before the slit. The outside air wanting to

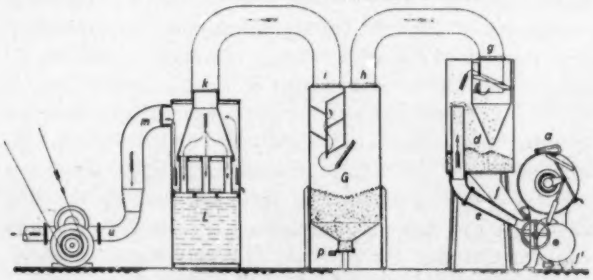

FIG. 5. INSTALLATION FOR SAND RECUPERATION

penetrate, carries with the sand to the reservoir and ejects it against the glass. For the sanding of hollow glass, an air vacuum is brought about in the two chambers wherein the articles to be treated secure a triple gyratory movement resulting in a back and forward and worm drive motion.

The dusting problem as well as the one regarding the recuperation of sand are in direct relation to the industrial application of these machines.

It would be difficult to describe in detail the course effected by the sand employed. It passes, except in the case of free blast apparatuses, to a closed circuit. For instance, as regards the air vacuum machines the sand having attained the article to be treated is sucked by a vacuum air pump, which by the way operates the whole installation, and brought back again to the reservoir *d*. In the latter, the sand falls and gets back again to the circuit as shown in figure *f*.

On the other hand the air and impurities are absorbed by a piping figure *g*, wherein they undergo a centrifugal movement which eliminates the former falling into a funnel. The remaining sand that may be left is done away in the reservoir, by the stop caused by the wings *g*. If there is any dust still remaining, it will be suppressed during its passage through the water *l*.

The output of this type of machine amounts for the flat glass of from 18 to 35 square meters per hour, according to the apertures and requires a motive power of 10 to 15 H.P.

For hollow glass the output is of from 120 to 150 articles of 150 millimeters diameter and absorbs 5 to 6 H.P. as motive power.

Distribution of Manufactured Glass Products

The Bureau of the Census report on the distribution of sales in 1929 of the manufacturing plants in the glass industry, issued from Washington a short time ago, shows the factories sales based on value as follows: 5% to manufacturers own retail branches, and from them passed to consumers. To wholesalers, including manufacturers own wholesale branches, 52.9% comprising sales to wholesalers, retailers and consumers; to retailers and from them to consumers, 7.9% direct to consumers, manufacturers of motor vehicles, perfumes, food products, etc.; chemists; dairies; contractors; householders; etc., 38.7%.

The census figures show that of the total sales by the above plants in 1929 amounting to $287,246,000, 52.9% or $151,822,000 were sold in this way. On the other hand over one-third of the total sales or 38.7% were to consumers. The total of the sales included above amounted to $16,573,000 less than the value of the products reported by the industry. This represents the value of goods transferred to other plants of the same company for their own use. Of the 263 plants engaged in the making of glass and glassware, eight transferred their entire output to other plants of the same company. The plants in this industry make glass and glassware from raw material, and are not engaged primarily in glass beveling, bending sheet glass, engraving glass, staining and ornamenting glass or making glassware from purchased "blanks." The principal classes of products are building glass, pressed and blown glass, wire glass, and glass containers of all kinds. A Census of Manufactures report giving preliminary statistics on production, wages, wage earners, etc., for the glass manufacturing industry was issued by the Census Bureau in 1930. A final report, in which these statistics will be presented in greater detail, will be issued shortly.

Commerce Year Book

Announcement was recently made by Eric T. King, Chief, Specialties Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, that volume II of the "Commerce Yearbook" for 1931 is now off the press. This is a source and reference book of foreign market data, contains 700 pages with maps, charts and tables, durably bound in buckram. It has come to be recognized as the most comprehensive compilation of foreign market data in a single volume. It is priced at $1.00 a copy.

The Manufacture of Rolled Plate

By ERNST LUTZ *

This work has been revised, so far as the English and the technical expressions are concerned, by F. W. Preston, who has also added a number of notes relating in general to the special conditions of American practice; but it must be understood that the opinions expressed in the text are those of Mr. Lutz, and neither the Editor nor Dr. Preston accepts responsibility for them.

(*Continued from the March, 1932, issue*)

THE WORKING OF THE PLATE GLASS EDGES. BEVELLING, SILVERING.

FOR sheets which are going to be framed it is sufficient if the clean cut edges are rounded off with pincers so that at least the danger of cracking due to very fine fissures of the edges is eliminated. Other types of sheets the edges of which remain uncovered as, for instance, table tops, wall and door protectors, large windows, sash-windows as well as unframed mirrors and the like, must have their edges prepared for the sake of appearance and also to prevent injuries to hands, etc. The surfaces of the edges are ground straight and smooth and the arrises either rounded off or simply bevelled. To this end rotating cast-iron discs fed first with sharp sand and then with fine. For the further elaboration, the edges and the clampers are smoothed by rotating sandstone discs of very fine structure. Sometimes wooden discs are resorted to, fed with fine pumice-stone. For polishing, wooden or iron discs covered with felt and rouge are used.

Figs. 201 and 202 show a few types of hand operated machines whilst Figs. 203 and 204 represent automatic bevelling machines of high output*. Very often machines with the frame supported in a nearly vertical position and leaning slightly backwards are still met with, the grinding discs being mounted with their axis horizontal and fitted in a movable support. The grinding discs press gently against the sheets as they move to and fro with the frame. This pressure can be increased if required with the aid of a counterweight (Fig. 205). These machines must be built very rigidly, as otherwise they are apt to vibrate and the grinding discs will not exert a constant pressure on the glass, thus producing less perfect bevels than the above mentioned machines with vertical disc-axis.

Special machines are in existence for the working of circular and oval sheets. Their movements can be so set that they follow automatically the contours of a sheet.

Fig. 206 illustrates a Waldrich bevel polishing machine; the blocks rotate and at the same time carry out a to and fro movement.

A great output with a minimum of attendance is obtained with grinding rolls. Fig. 207 illustrates such a roll with an iron cylinder for rough grinding, whilst Fig. 208 represents a roll of natural sandstone for fine grinding. Apart from their rotatory movement the rolls also move slightly forwards and backwards in the direction of their axis, so that the bevelled edges of the glass show no strings and the rolls

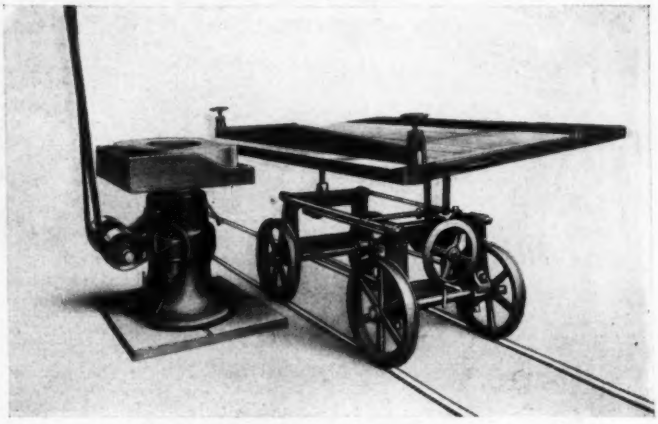

FIG. 201

wear uniformly. One edge of the sheets is supported on a rod in front of the roll whilst the opposite edge, which is to be worked, rests on the roller body; to ensure a sufficient grinding pressure the sheets are loaded by small weights. The iron discs are fed with wet sand, whilst the sandstone rolls are simply wetted with water. With rolls, the liability of breakage is less than with machines operating with rotating discs. They are therefore preferably used for the working of large glass sheets; on the other hand they produce hollow facets which have a less satisfactory appearance than plane ones.

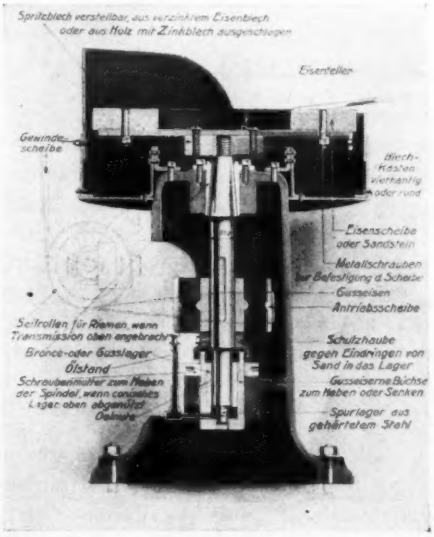
Spritzblech verstellbar, aus verzinktem Eisenblech
oder aus Holz mit Zinkblech ausgeschlagen
Eisenteller
Gewinde-scheibe
Blech-Kasten viereckig oder rund
Eisenscheibe oder Sandstein
Metallschrauben zur Befestigung d. Scheibe
Gusseisen
Antriebsscheibe
Seilrollen für Riemen, wenn Transmission oben angebracht
Schutzhaube gegen Eindringen von Sand in das Lager
Bronce-oder Gusslager
Ölstand
Schraubenmutter zum Heben der Spindel, wenn conisches Lager oben abgenützt
Gusseiserne Büchse zum Heben oder Senken
Spurlager aus gehärtetem Stahl

FIG. 202

*Of Desseau, Germany. This work is appearing in German in the new edition of *Dralle-Keppeler*, "Die Glasfabrikation."

FOOTNOTE: In the Figures, originally prepared for use eventually in the new edition in the German language of *Dralle-Keppeler*, "Die Glasfabrikation" in 1931, dimensions are given in metres (*m*) and millimetres (*mm*). We would like to have given these in feet and inches but the translation and the making of nearly two hundred and fifty new illustrations would have involved a prohibitive loss of time and expense. To some of our readers the metric system is as familiar as the English units; for the others we may say that a metre is approximately 40 inches, and a millimetre is approximately 1/25 of an inch. A thousand millimetres, of course, go to a metre.—F. W. P.

So far as output is concerned the automatic bevelling machines mentioned before are in no way inferior to rolls, but may actually, under certain conditions, be superior; therefore for high grade sheets rolls are nowadays no longer used. Such rolls are built up to a 5′ diameter and more, but even then the concavity of the bevel impairs its aspect. The

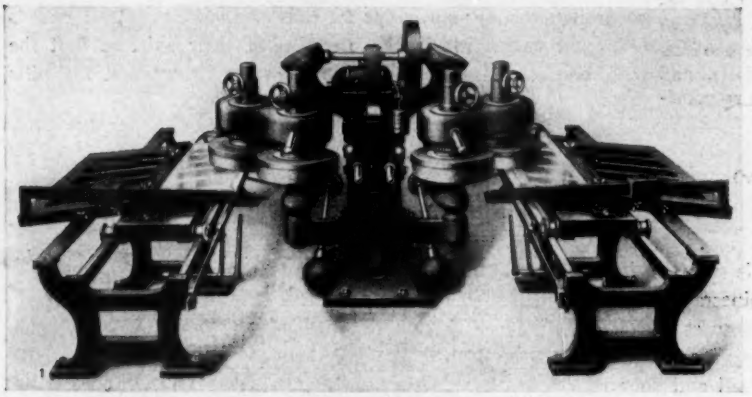

FIG. 203

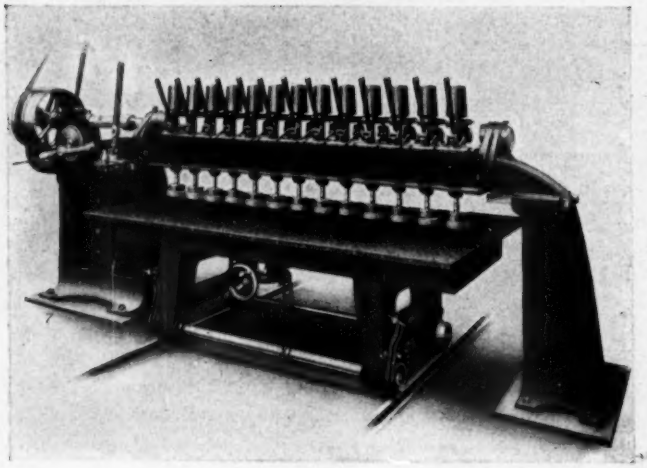

FIG. 204

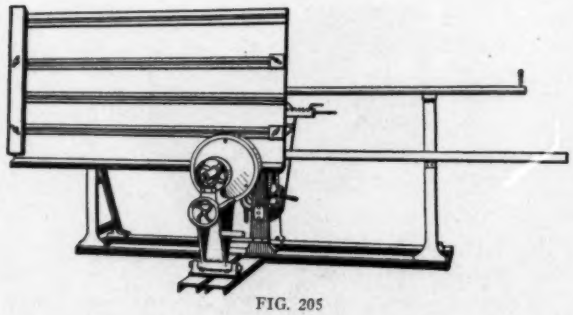

FIG. 205

fine grinding rolls which wear relatively quickly, are kept in service down to a very small diameter for the sake of economy; this results in its not fitting properly with the concavity left by the iron roll. Again, natural sandstones are rarely of uniform and homogeneous structure or of equal hardness throughout, which in itself causes an unequal fine grinding, and furthermore, the soft parts wear more quickly than the hard ones, so that the surface of the stone gets wavy and pitted. The necessary frequent trueing-up accelerates its wear. For further information and details on the lay-out and management of bevelling and facetting shops reference shall be made to a report in the glass journal *Diamant*, Leipzig, No. 36, of the year 1910, and numbers 1 and 2 of 1911.

For the tranformation of glass sheets into mirrors, one of their surfaces is covered with a reflecting metal layer. Those frequently used are amalgam of tin, platinum and silver.

The amalgam of tin is produced by pouring over a tinfoil lying on a perfectly plane and horizontal base, as much mercury as will hold on by itself. On to this mercury the glass sheet is put and pressed down by weights, screws or springs until the surplus mercury has been squeezed out and the remaining amalgam film is dry and sticks firmly to the glass; this takes about 24

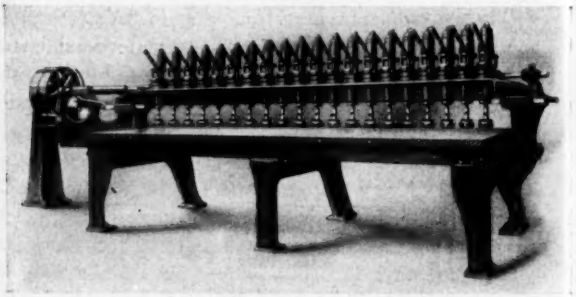

FIG. 206

hours. After that the sheet is placed vertically so that all surplus mercury can flow off. In this position the sheet is left for about 2 to 3 weeks until the foil has become perfectly solid. For its protection it is covered with a neutral varnish. The surface of the tinfoil

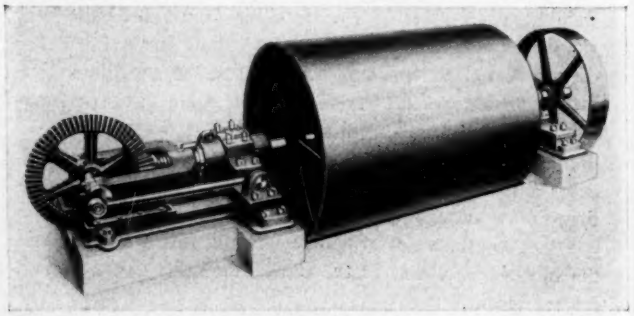

FIG. 207

must, not be appreciably oxidized, as oxide of tin is difficult to amalgamate. Before the mercury is poured, the tinfoil, with the aid of a little cloth or a fine brush, is brushed carefully with mercury so that every part of its surface comes in contact with it, thus dissolving pre-existing oxide of tin and

creating a pure metal color on the surface. In all directions the foil is made ⅜ to ¾" larger than the glass sheet to be covered, so that the edges of the latter are everywhere submerged in the quicksilver.

The mercury should be perfectly pure, i. e. free from organic impurities such as dust, soot and the like and also

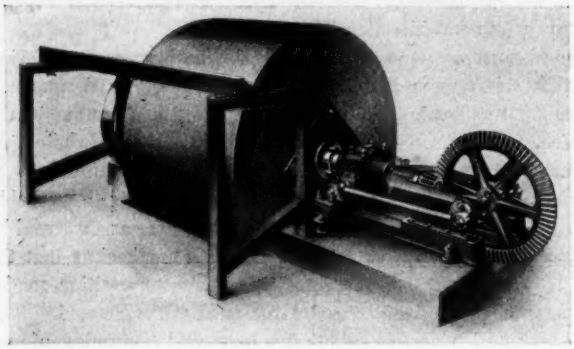

FIG. 208

free from foreign metals, of which lead, bismuth and tin are most apt to be present. Such mercury can be obtained of a fairly high purity; however, as a precautionary measure, before its application it is pressed through leather whereby mechanical impurities are strained out. In case foreign metal is present in appreciable quantities, the mercury is evaporated in vacuum and then condensed again; this procedure permits the separation of foreign matter to a sufficient degree of perfection.

As a base for the setting of the tinfoil perfectly plane stones (very often marble tables) are used, the tops of which can be tilted for running off and recovering the surplus mercury. The tinfoil must not show any transparent spots or any hollows or cracks; if placed against the light it must appear undamaged and opaque. The foil must consist of purest tin and contain only the merest traces of lead, which causes a grey and subdued aspect. Further, the smallest amount of iron present impairs its lustre and color. The color of pure tinfoil is almost equal to that of polished silver, from which it differs only by a hardly discernible yellowish hue. The image in the mercury mirror which in itself is somewhat sallow, gets a further unsightly greenish tint if lead and iron are present, but this can be corrected in some measure by the addition of nickel and copper.

To prevent dust and other impurities from settling in between the plate glass and its cover, the surface of the mercury is cleaned with a glass rod, immediately behind which the sheet is pushed on to the mercury. Instead of the glass rod an edge of the sheet itself may serve for the said purpose; this edge, however, must be very clean, cut true and be well ground. Of course the surface of the glass which has to be silvered as well as its edges have to be perfectly free from dust, dirt and grease. For the cleaning of the glass finely sieved wood ash is used and then completely removed with linen rags. Even the smallest impurity sticking to the covering will soon start to deteriorate the latter so that the mirror will get specks which in the course of the years extend, develop and gradually spoil it altogether.

The surplus mercury, which after its use is recuperated, contains tin, and must be purified before being used again. For this purpose it is pressed through leather. If thereon appreciable residues are found, the mercury is refined by a distilling process.

Mercury mirrors reflect white light with a greenish cast; the human face appears in it pale and sallow. Silver mirrors on the other hand reflect the light with a slight tint of red, which causes the image to appear in fresh colors. For this reason silver mirrors have become quite generally preferred to the mercury ones. Above all, however, it is the harmful effect of the mercury on the health of the men employed in the "silvering" process, which has been the reason that the manufacture of mercury mirrors has been more and more restricted.

In platinum mirrors the glass sheet merely serves as a backing and supporter of the metal foil. Platinum is absolutely unaffected by the air and maintains its polish, so that it can be used directly as a front surface mirror. A particularly sharp reflecting mirror is obtained if black glass is used as carrier. The foil of platinum is produced by painting or pouring on to the glass a solution of platinum chloride with lavender oil in alcohol, or a solution of platinum-chloride in boric acid. The sheet thus covered is heated up to red heat and slowly cooled again, which process produces a tightly adherent, beautiful, and brilliant metal mirror surface on the glass. The production of a smooth and uniform cover requires special precautionary measures and great craftsmanship.

Platinum mirrors are produced only on a very small scale and mainly for scientific purposes. The silver mirror is the only one of real importance today. It consists of a pure silver foil on the back of the glass sheet protected against damage and atmospheric influence by a neutral varnish or by a galvanoplastic copper film.

The most usual procedure for the production of a fine silver cover consists in pouring over the carefully cleaned glass surface an alkaline silver nitrate solution. Immediately before the pouring takes place, an alkaline reducing agent is added, which soon causes the formation of pure silver, deposited as a shining skin on the glass surface and firmly sticking thereon. It is essential that this sediment should form a perfectly smooth and uniform skin, as a rough and incomplete one would not act as a mirror, and furthermore, after its drying would drop from the glass while a solid, smooth surface adheres firmly.

The silver nitrate solution is called silvering liquid, and the solution of the reducing agent which has to be added is called precipitating or reducing solution. The former usually consists of a saturated solution of silver nitrate in ammonia and distilled water; in many processes this solution also contains some caustic alkalis like solutions of caustic soda and caustic potash. However, it is difficult to procure these alkalis in the required purity, so that procedures which do without it are preferred; the merest traces of chlorine and sulphur are detrimental to the silver foil. Depending on the composition of the silvering liquid and on

the particular procedure various reducing solutions may be used, such as lacton, glucose, invert-sugar, aldehyde-ammonia, tartaric acid, seignette-salt and many others. There are an enormous number of suggestions and procedures actually carried out, which depending on the customs and the craftmanship of the silverer, yield more or less perfect and lasting covers. When choosing a procedure an eye should be kept on costs. Again depending on the nature and the composition of the various solutions, the work is either done "warm" or "cold," i. e., the one or the other of the liquids is produced hot and the silvering done on a pre-heated table, or on the other hand all this work is done at the ordinary room temperature. It is claimed that cold working gives a more lasting cover; however, this opinion cannot be regarded as of general validity, as the most favorable temperature depends on the solution applied and also on the way of working.

The metallic silver is very sensitive and it is therefore important for the production of a good and lasting cover that the chemicals and the distilled water which are used, be perfectly pure and that the glass to be silvered be free from any dirt and dust. Even the faintest finger marks, dust particles, fly excrement and the like may spoil the result right away; but in any case, they will spoil the cover in time. Glass sheets which have been in stock for rather a long time and the surface of which has already been somewhat influenced by the atmospheres (a thing which will happen with any sheet which is not quite fresh), impair the quality of the cover. For this reason only freshly polished sheets should be used. Shortly before the covering the glass sheets are cleaned with finely sieved ash, Vienne chalk or the like, then washed with the aid of distilled water and a chemically cleaned sponge, and finally rubbed dry with chamois-leather. This latter must be done in such a way that no stripes are left on the glass. Immediately before the liquid is poured on to the surface, the latter is again washed with distilled water and sometimes also with diluted alcohol and diluted silvering liquid. Water must be used in distilled form only and every silvering shop therefore has to be equipped with a distillery. Condensed steam from steam boilers does not meet the requirements, as such water usually contains sulphuric acid and chlorine.

Further, when varnishing and galvanizing the back surface of the mirror for the protection of the silver foil, very severe measures of precaution have to be followed, so as to save it from gradual decay.

As mentioned before, a great number of silvering processes and methods of working are in use; almost every silverer in the course of time follows his own recipe; this is the reason for so many faulty methods. It is advisable for the works manager to subject the work of his men to a close and constant inspection so that private and secret customs, which might prove very harmful, cannot develop. Various methods are described in detail by Ferdinand Cremer in: "Die Fabrikation der Silber—und Quecksilberspiegel, Wien und Leipzig." Therein are given also particulars on production, testing and purifications of the chemicals required. It is referred to in "Das Glass in Einzeldarstellungen" publishcd by Dr. Gehlhoff and Dr. Quasebart, volume 10 "Die Glasveredelung" by Karl Hesse. While the book spoken of is confined chiefly to information about prescriptions and empirical experiences of the mirrorsilver-production, V. Kohlenschuetter and E. Fischmann[1] record an analysis of experiments conducted systematically according to modern principles of natural science and chemistry, regarding the nature and characteristics of mirrorsilver and the mechanism of its formation. Older literature on this subject is also taken into consideration.

It must be stressed how great is the danger of explosion that arises from letting solutions of concentrated ammonia and silver oxide stand for some time, for it results in the formation of the very explosive Berthollet fulminating silver[2]. This, however, is not a composition analogous to fulminate of mercury but, according to Raschig, is probably a substitutional product of ammonia by silver as expressed by the formula NAg_3 or $NHAg_2$. Raschig emphasizes that the statements about the inclination of this composition to decompose explosively are by no means exaggerated. The Laboratories for Glass Technology and Ceramics of the Technische Hochschule, Hannover, found out by experience that silver oxide must not be permitted to come in contact with concentrated ammonia. Therefore, the observation of the following rules for the handling of the ammoniacal solutions of silver is recommended:

1. The silver oxide precipitated from silver nitrate by means of potassium should not be dissolved with ammonia until the solution containing the sediment has been diluted in the proportion of 2000 cu. cm. of fluid to each 7 grams of silver nitrate.
2. This solution should not be kept only in bottles that are completely filled up and closed perfectly.
3. The solution should not be kept more than one day in the prescribed storage; it is best produced immediately before it is mixed with the reducing fluid (sugar solution).
4. Under no circumstances must a supply be produced for a longer period of time.
5. Any warming and exposure to light must be avoided.
6. The reagents employed should be subject to a little advance test: 0.7 g. silver nitrate dissolved in 25 cm^3 water and 1,4 g protoxide of potassium dissolved in 25 cm^3 water are mixed in a 2000 cm^3 flask with stopper and diluted with 150 cm^3 of water. If ammonia is added drop by drop, the sediment of silver oxide must dissolve, in measure as new separation must take place. A little surplus of ammonia cannot do any harm.
7. The silver nitrate must be protected from light; therefore it is stored best in brown bottles.

As regards problems of the protection of workmen in general, information may be found in the chapter: Dr. B. Schrieber, Hygiene der Glasarbeiter und Spiegelbeleger in Weyls Handbuch der Hygiene[3]. (Hygiene of the workmen in the glass working and silvering industries in Weyls Handbook of Hygienics).

[1] Liebig's Annals of Chemistry, Vol. 387 (1912), pages 88-145.

[2] Berthollet, Crell. Ann. 1788, 2. 390.—Raschig, Lieb. Ann. 233, 93 (1886).—C. Matignon, Bull. Soc. Chim. de France (4) 3 (1908), 618; ref. Centralblatt 1908, II, 136.—Sievert, Zeitschrift ang. Chemie 22 (1909), S. 6.—For general information about accidents refer to Edli and Rüst, "Unfälle beim chemischen Arbeiten" (Fuerich 1915, Rascher & Co., A. G.).

[3] This chapter may be obtained separately as number 30 of the Handbook together with the chapter dealing with the hygiene of the ceramic industries and of the phosphorus workers.

THE LAY-OUT OF PLATE GLASS FACTORIES

In addition to the output intended, the size of a factory, its form and the details of the site at disposal are of fundamental importance in the choice of the lay-out and the arrangement of the whole plant. The furnaces and the grinding and polishing machinery require large excavations and deep foundations. The straight grinding and polishing lines must also have extraordinarily solid foundations. If the subsoil is not perfectly firm throughout the entire length, the foundations must be built so that they hold themselves on a few points and span over unsafe spots of the ground, for hollows and errors of level in the line must be eliminated by all means. In case the water conditions do not allow sufficiently deep building it is necessary to raise the working floors of the factories higher than the ground level which means expensive iron- and concrete-constructions. It is necessary especially with regard to the furnaces, which ought to stand perfectly dry, to raise the working floors. It must be watched that the bunkers and storing places for the relatively large amounts of raw materials and auxiliary materials as well as the packing room and the shipping platforms are at a proper level relative to the top of the rails of the railroad siding, as otherwise expensive and complicated apparatus for loading and unloading would be required. A satisfactory railway communication or a favorable ship wharf may decide the choice of a site, because without such communication the factory could not exist. Further the possibility of procuring coal or gas and grinding sand easily and cheaply is of great importance; we need also a supply of best white sand and limestone, and finally a suitable labor supply must be available or at any rate, the circumstances be favorable for its settlement. It is advisable to be connected up with a large electric power station for the supply of cheap electric current. If it is not possible to dispose of the great amount of silt from the grinding shop in a natural and inexpensive way and to continually replace the water, for example from a nearby river, a large area is required for the settling of the silt and for the cleaning and recovery of the water. Ample ground space must also be provided for the rubbish originating from the rough glass hall as well as the grinding and polishing shops. If there is no possibility of easily getting rid of the silt and refuse, even small works must provide at least 20 acres for this purpose. For the factory buildings alone, i.e., without the ground required for dwellings, welfare institutions and the like, one should not go below 25 acres, which leaves but a small margin for later extensions. Inclusive of the settling ponds and the rubbish-heaps there are thus at least 45 acres to be provided, and for larger factories correspondingly more.

The lay-out of the works, i.e., the connection between the casting hall and the grinding and polishing shop, the plate glass store and the packing and unloading shops, is dictated by local conditions. The other sections, like the pot and brick-making department, the locksmith's workshop, the blacksmith's shop, the joiner's shop, the raw material stores, the silvering and the beveling shop, as well as the administration building and the doorkeeper's lodge have to be added in keeping with the rest of the plant. In case the electric power is not supplied from outside, consideration must also be given to the power and boiler house. The combination of Figs. 2 and 125 gives an example showing how the rough glass hall, the grinding shop, etc., in plants with circular grinding and polishing tables can be joined satisfactorily; at the same time reference may again be made to Figs. 49 to 52 and also to the corresponding text. Figs. 209 and 210 show two further possibilities. These illustrate lay-outs of older plants which have originally been intended to work with single chamber annealing kilns. The lehr which was added later, in both cases could be so fitted in, that the new stationary casting table had a favorable position relative to the melting furnaces, and that the runway of the lehr at its exit end came near to the original rough glass store and the laying berths, or at least could be easily connected up with same.

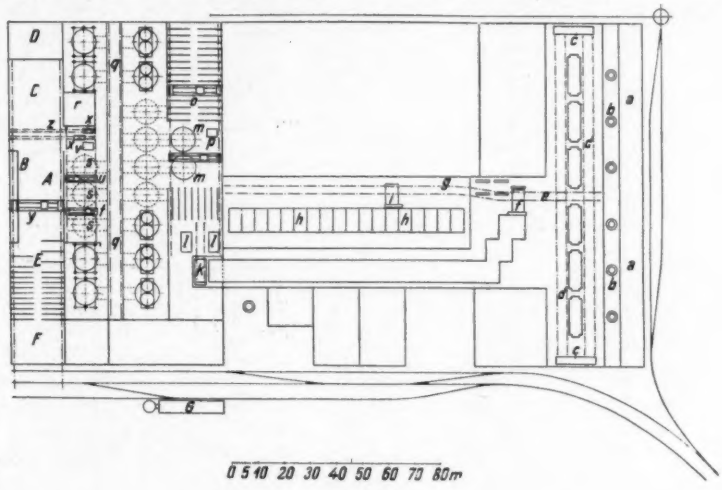

FIG. 209

With an arrangement as shown in Fig. 209 for example, four to five melting furnaces may be in commission whilst one to two are under repair or standing by; the lehr is of the size No. I (see page 86, April, 1931, issue); at a,a the gas producers inclusive of the coal bunker

for the melting furnaces and the lehr are situated; the stocks are indicated at b, the pot arches at c. On each of the two rails d,d a pot-removing machine as shown in Figs. 40 and 41 works; the teeming crane runs on the overhead rails e. These rails run over the new stationary and watercooled-casting table f; their extension g goes along a row of single annealing kilns h, which have been left there for the annealing of thick rough glass sheets; the corresponding travelling casting table is indicated at i. k is a removable roller table with which the annealed rough glass sheets are conveyed to the cutting table l,l which can be tipped. m,m indicate the laying berths; above these and the rough glass store a tong-crane and a cleaning room z. It indicates a vacuum-crane, u a tong-crane and v a tipping table. From the cleaning room the sheets are brought to B for inspection; A indicates the glass cutting shop, C the extra polishing room, D the beveling and silvering plant, E the wareroom and F the packing room. This room, from C onwards to the railway-rails, is within the reach of an overhead tong-crane y.

The space left between the melting hall and the rough glass store o, alongside the annealing house can be used for the preparation of the batch material and for the manufacture of special glass, like wire, figured, and thin rough glass[1]; in the space on the opposite side of the annealing house, in between the melting and the packing shop, the

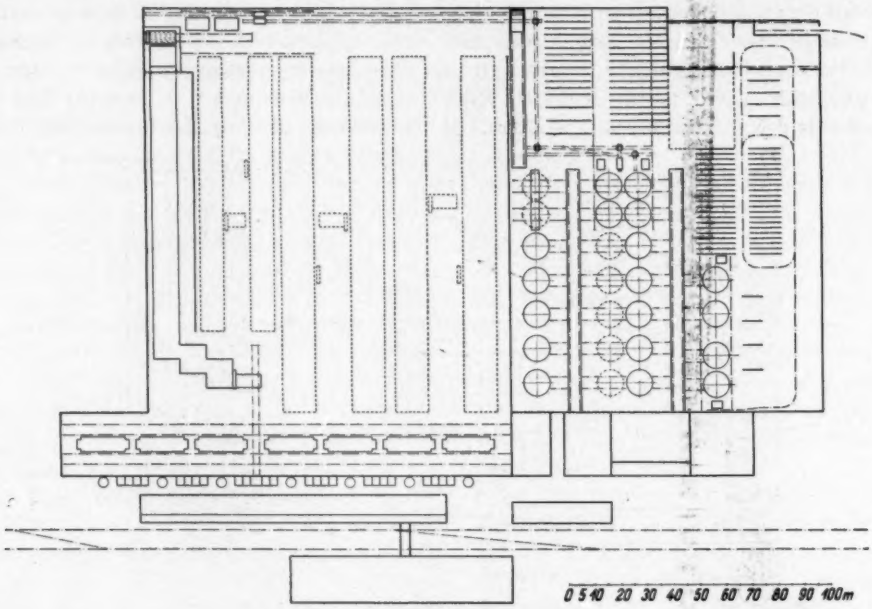

FIG. 210

vacuum-crane o move; finally, p is an electrically operated tipping table.

The grinding shop operates with five grinding machines, each with two grinding tables; the polishing shop is equipped with four polishing machines according to the design illustrated in Figs. 155-157. With the progress made in the utilization of the grinding machines, these four polishing apparatus are no longer sufficient for the five grinding machines, in such a case and in order to utilize fully the five grinding machines, one has been forced to install three to four further machines of the same design or two to three of a different type. Alternatively, if an extension of the rough glass hall is undesirable, only one or two new polishing machines would be erected and a further one to two grinding machines would be changed into polishers.

The track of the transfer table for the insertion and withdrawal of the grinding tables is indicated at q,q; in the basement below these rails the main drive shaft is situated which through ropes and belts indirectly drives the grinding and polishing machines. The main driving set is placed in the room r. At s,s the table settings are turned and the sheets polished on both sides, taken off and put on the narrow gauge trucks x, on which they are conveyed to the pot- and brick-making department, the repair shops, the raw material store and the power house can be arranged. G indicates the unloading place and the store for the grinding sand, which is conveyed from there on to a make-up plant with the aid of mammoth pumps.

Figure 211 is taken from an older edition of "Dralle, Die Glasfabrikation" which showed originally the lay-out of a plant with single annealing kilns. A lehr is now shown as actually installed and erected at a later date. There are four melting furnaces, 6 grinding and polishing machines for tables of 28 feet diameter. The machine driving the common main transmission shaft for the grinding and polishing machines stands at q.

In the table are further shown: a the keeper's lodge, c,d stacks 140′ height and 4¼′ diameter, two of which are provided with a water storage tank of 1240 cubic feet, i the mixhouse, the pot and the brickwork making, n the sand grading up plant; p and v the rooms for the final polishing of the high quality sheets; w the beveling and silvering shop; u the store for the box lumber; x the box-maker's shop;

[1]Figure 236 E shows the later plan of the melting and annealing house of the same plant. One may see from it how in the meantime a part of this ground has been utilized for the installment of a Bicheroux rolling machine with two annealing ovens running straight all through.

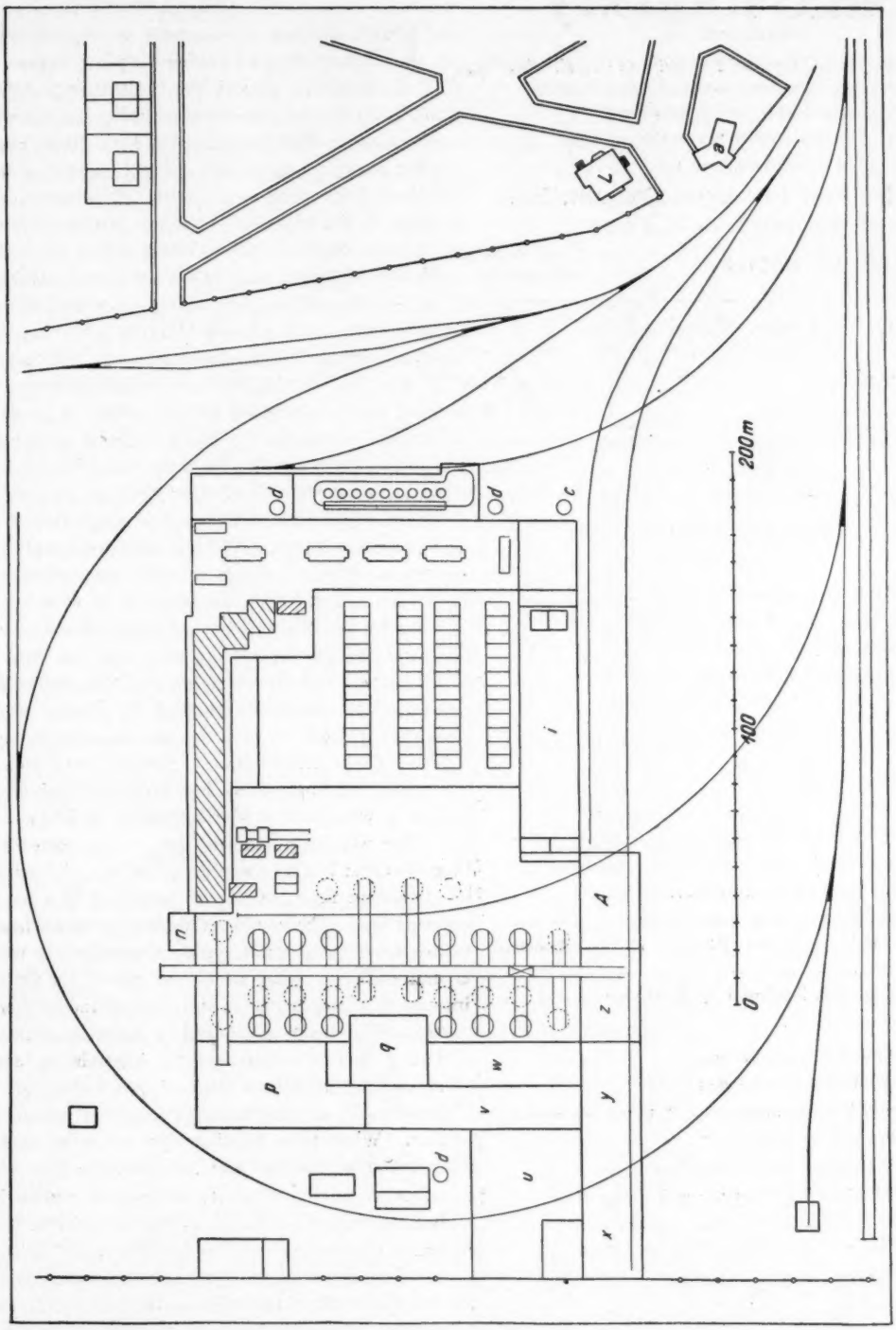

FIG. 211

y the packing and storeroom for polished sheets; z the repair shop. A the loading room for rough glass plates and L the administration building. Figures 135 C and 135 E show how well the grinding and polishing shops with straight and continuous lines together with the shops for cleaning, examination, and cutting, and the warehouse can be annexed to the end of the annealing oven, to the rough glass cutting shop and the rough glass store.

(To be continued)

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Reference to the contents of earlier issues of THE GLASS INDUSTRY can be found in THE INDUSTRIAL ARTS INDEX in many Public and Technical Libraries.

Human Relations

By ROBERT D. KOHN*

THE material achievements of engineering and science during the past half century are indeed an indication of the wonderful possibilities of the trained mind. But from my point of view that same mind has not distinguished itself by meeting other problems that have grown even more complex in this same period. The benefits that men have received from science are fairly well known. Why try to make a list of them? Such a process appears academic. Is it not likely to lull us into a sleepy sense of repletion as if the job were well done; we have dined on succulent self-praise and can now rest? Or worse still, the pride of achievement may actually blind us to the important problem which science has not tackled at all. The present only too evident maladjustment (and indeed the misery from which some part of the world always suffers) is in no small measure an indication of a whole series of such vital problems.

It seems to me that the very real achievements of science and engineering fail of their effect because the human side of the world's problems has been neglected. We have been absorbed in things. We have neglected to notice the effect of men absorbed in things on other men absorbed in things. We have been proud, for instance, of what engineering has done to annihilate space. Transportation, telegraph, telephone and the press bring men from the ends of the earth into a new and closer relationship with each other. But we have done practically nothing to develop a technique of human relations to meet the new problems brought about by those closer relationships. Almost every step forward in science and engineering has produced similar new contacts and a whole series of concomitant problems and miseries.

The wonderful qualities of insight, patience, indeed the genius that has been applied to the material accomplishments of modern times, must now be turned to a much more difficult job. The results of these discoveries must be turned to a more worth while, a more comprehensive use. Scientists and engineers (and all of the rest of us for that matter) must now concentrate on the study of the relations of man to man, of group to group and of nation to nation. We must find a way to understand the interrelation and the interdependence upon each other of men within each function of modern life and the interdependence of function upon function. When these relationships are better understood they will become clarified and then be more just. And the distribution of the products of modern production and the benefits thereof (material as well as spiritual) will then be better adjusted, because of necessity that distribution will be based on a recognition of the essential nature of the contribution that each group makes to the needs of the whole. And a whole world of latent talents will be evoked during this process.

By far the greatest benefits are still to be conferred on the world by the scientific mind and engineering skill. They will produce in the future still greater inventions. The physical sufferings of mankind will be relieved by further beneficent discoveries of medicine and advances in surgery.

*President, The American Institute of Architects, in "Research Narratives," December 1, 1931.

But my hope for the future lies in the belief that we are about to shift the direction of our efforts because we have realized that progress lies in another direction. Doubtless the work in study and laboratory should go on; but the leaders of research and the forward-looking men in all the skilled vocations must now turn to a new leadership. It is their duty and their privilege to direct a study of the much more difficult problem in the neglected field of human relations. These are not problems that can be solved by the few working alone in a laboratory. It is a job for the many, out in the open with the whole world as a field of action. There is a new art to be created super-imposed on material science next to which in complexity modern science is simple. An art it will be because it must develop a sensitiveness to the infinite variations, to the differences in values of personalities and each such perception will have to be interpreted by other personalities.

The painful inefficiency and injustice of our present civilization shows us that this is the great task. Some say that the essence of this task is the basis of all of religion. Others believe that it is the spiritual background on which a new democracy is to be built. Whatever its name, it is a job that we must tackle for we live in an age of idiotic contrasts. Part of the world is starving with the food bins elsewhere bursting with a surplus of food. The rest of the world is spiritually starving because of a plethora of the thousand and one material blessings. I am not interested now in a review of the scientific skill that has produced these things. I want to see it apply itself to working out a new vision of human relations.

Correspondence

TO THE EDITOR:

Professor W. E. S. Turner, referring to Notes on Nature of Glass in the November, 1931, number[1] of THE GLASS INDUSTRY, tells me that Sir William H. Bragg is still alive and very active and cheerful; that he has in fact been one of the central figures in the Faraday Celebration in England. It certainly is a pleasure to know that with a lifetime of achievement already behind him Sir William can still look forward to years of active work.

CORNING GLASS WORKS,
CORNING, N. Y. (Signed) E. C. SULLIVAN,
December 12, 1931 Vice Chairman

[1]Page 218.

MY DEAR EDITOR:

I am returning to you under separate cover the book, "The Glass Industry," that you were so kind as to let me use. The boys have been especially interested in glass, and one boy especially, Richard Franke, 11 years of age, who wrote an essay, "The Study of Science of Glass," after having studied the subject for one month. This essay I am enclosing for you and would like to know what you think of it.

Thanking you again for your kindness,

Sincerely yours,
(Signed) HELEN ROMAINE BRADLEY,
Vocational Guidance Dept.

EDWIN GOULD FOUNDATION FOR CHILDREN,
598 Madison Ave., at 57th St.,
New York, March 15, 1932.

(*See Next Column*)

The Study of Science of Glass

Written by RICHARD FRANKE
Eleven-year-old Science Student

I. The Three organizations connected with glass manufacturing are:
   (1) National Glass Organization.
   (2) Bottle Blowers of United States.
   (3) American Flint Glass Workers Union.

II. Needs of the Industry:
   The need of having a glass industry is to have more competition between this country and foreign countries. This means that more action should be put into the lives of our countrymen and to have a better glass than our foreign sisters and brothers.

III. Sand:
   Sand is the most used particle in the making of glass. It looks like rock in large sizes. It is then taken to quarries and pounded and later put through a test called washing. This kind of sand is used for making cheap glass; such as:
   1 Jars for jam.
   2 Isolaters.

IV. The Blowpipe:
   The blow pipe is an iron tube which is about 4′ to 5′ long. At the end is a place for blowing through with the mouth.

V. Window-Glass Machine:
   A ring is dropped into the surface of molten glass and the glass sticks to it because of something like a magnetic force. When the ring is pulled upward towards you a cylinder of glass adheres to it. A man in a station about 12′ above the floor pulls up about two to three cylinders at time.

VI. The Uses of Glass:
   1 Lamps.
   2 Electric lights.
   3 Skylights.
   4 Auto lights.
   5 Flood lights.
   6 Window panes, etc.

VII. A few reasons for the use of glass:
   We use glass because there are many famous things from the old times which we put on display in glass cases. If it weren't for glass many things would have perished. A few questions that could be asked the world are:
   1. Why do they use glass to preserve Washington's swords and his boots or other precious things belonging to Washington?
   2. Why do they put the thought body of King Tut or Tutankhamen in Glass?

VIII. Glass in Service in the World War:
   Glass was used more efficiently in the World War in their sighting towers to espy what the

enemy was doing or if they could see any hidden guns that were used in hacking down their soldiers.

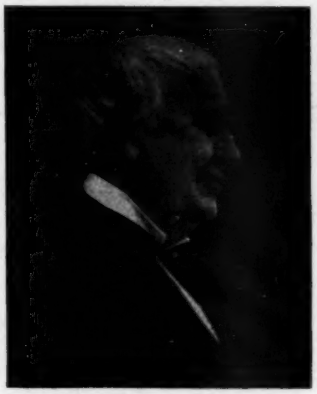
IX. Glass used as help to the eyes:

During the war men's eyes were becoming dim because of smoke and dust. When they got home they were practically blind. Some recovered after months of rest, but others had to be thankful for glasses to see through.

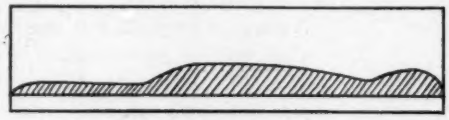
X. The next few pages will be of diagrams:

AT RIGHT—
A PORTRAIT OF THOMAS ALVA EDISON

BELOW—
AN INCANDESCENT BULB MADE BY THOMAS ALVA EDISON, AS YOU WILL SEE HIM HERE, BEFORE HE TOOK SICK AND DIED ON OCTOBER 18, 1931



Courtesy New York Edison Co.



THE FIGURE OF A MUMMY KEPT IN A GLASS CASE

THOMAS EDISON, MAKER OF THE INCANDESCENT BULB AND MANY THOUSAND MORE ARTICLES, WAS DEAF BUT IN SPITE OF THIS HE USED HIS INTELLIGENCE AND WON OUT IN THE END. IN HIS MANY THOUSANDS OF INVENTIONS HE USED GLASS MORE THAN ANY OTHER THING

XI. Molds:

Molds are hot furnaces in which glass is melted and after it is become softened and then finally turned into a liquid, it is rolled and made into a large sheet for windows in stores.

Trade-Mark Registration Under State Laws

FEW trade-mark owners realize that the registration of a trade-mark in the United States Patent Office is merely evidence of the registrant's right to the exclusive use of that mark in interstate commerce. In other words, it is quite possible for one man to be the owner of a given trade-mark within a certain state, while another person may have the right to the exclusive use of that mark in interstate commerce.

This situation arises from the fact that the several states have never surrendered to the Federal Government jurisdiction over commercial transactions wholly within a state, the use of trade-marks being an incident of commercial transactions. In fact, the majority of the States have enacted laws governing the use of trade-marks within the State and in most cases provided for a register for such trade-marks.

These State laws have adhered to common-law principles governing the acquisition of trade-marks and have predicated ownership of trade-marks on priority of adoption and use. But there is no question that any State (barring a specific prohibition in its Constitution) could today enact a trade-mark law similar to the laws of Argentina, Japan, and many foreign countries where trade-mark piracy is common. Under these laws the exclusive right to the use of a trade-mark may be granted to the first applicant for such right regardless of prior use, provided that any such law enacted made specific provision for the recognition of trade-mark rights previously acquired in accordance with the principles of law theretofore governing the same.

Many states have gone further than the Federal authorities and have incorporated in their trade-mark laws a provision found in some foreign trade-mark laws, particularly that of Cuba, making the registration of trade-marks mandatory or obligatory. For instance, one law provides that whoever "has heretofore adopted or used, or shall hereafter adopt or use" not only a trade-mark but "a label, trade-mark, term, design, device or form of advertisement . . . . shall file the same, etc." While no penalty is provided for non-filing, it is stipulated that a certificate issued under the act shall "be sufficient proof of the adoption," and it might properly be held that no other proof could be "sufficient."

Another common provision of State trade-mark laws is one affording summary punishment of infringers by means of fine and imprisonment. Trade-mark owners and others interested in trade-marks, recognizing the extent of wilful trade-mark infringement and the damage done thereby will do well to remember therefore that most State laws already include such provisions.

Another feature common to most state laws is that providing for the registration of trade-marks that have been "adopted" as well as those that have been used. Before valid application for federal registration may be filed, the mark to be registered must have been actually used—and used in interstate commerce. The requirement of such use is onerous to many who dislike for one reason or another to delay making application for registration of their mark until labels for each of their products showing the mark have been completed and bona fide interstate shipments made. This is particularly true where the trade-mark is to be used on a long line of goods and where it may be a year or more before the complete line is marketed. It is common knowledge that many current applications for federal registration are based on labels made up for the purpose. Having in mind this requirement of user in the federal law, it may often be found advantageous to take out a preliminary claim under a State law based on adoption.

It is doubtful whether any specific rights are acquired by adoption of a trade-mark or registration of a claim to adoption under a State statute without user. But such registration acts as a constructive notice in the jurisdiction of the registration office and might be held to prevent the adoption and use of the same mark in good faith by another subsequent to said registration and prior to actual use by the registrant. Thus the registrant's rights might be protected, to a certain extent at least, between the time of adoption or registration and the commencement of actual use.

Another distinct advantage of State statutes is the broad view of what may constitute a trade-mark or means of business identification taken by most of them. Thus we find the Pennsylvania law provides for registration of "any label, trade-mark, trade-name, device, shop-mark, designation or form of advertisement." The California law covers "every description of work, letter, device, emblem, stamp, imprint, brand, printed ticket, label, or wrapper . . . . . and any name or names, marks or devices, etc." Other state laws are correspondingly broad in this respect, as well as in respect to who may be the owner of a trade-mark and as to the nature of the business which a trade-mark may identify.

Thus, while a trade-mark used in the business of advertising as such is not registerable under our Federal statutes, nor is the trade-mark used by the members of an association not itself engaged in commerce, such trade-marks are specifically registerable under many State statutes.

In general, the jurisdiction of State legislatures and courts extends only to acts committed wholly within the State and to disputes between citizens of the State, and State trade-mark registration will, therefore, be found to be of greatest value in such cases. They may also, no doubt, be valuable as evidence of certain facts in other controversies in other jurisdictions. The fee for registration in most states is nominal and the dispatch with which registration may be obtained is in sharp contradistinction to the untoward delays that often attend the securing of federal registration.

Turn Slip Checks Losses in Production

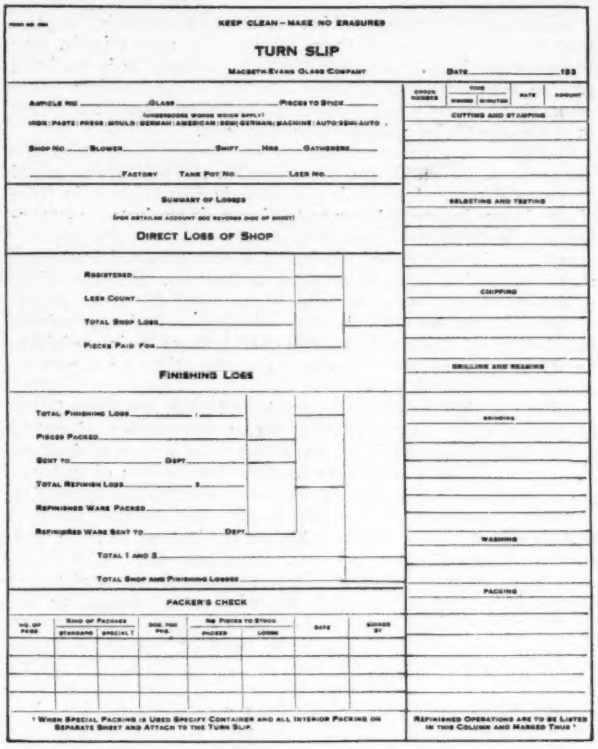
Wm. A. Fawcett

THE turn slip shown here is used by the Macbeth-Evans Glass Company, of Charleroi, Pennsylvania, to follow production. G. A. Rothrauff, auditor of the company, describes the use of this form as follows:

"The record originates with the blower, who keeps track of the number of pieces made, which amount is indicated in the 'Registered' space. After the ware comes through the leer, the leer man makes another count, which is inserted in the 'Leer Count' space, while the leer loss is shown in the first space on the back of the sheet, under the heading 'Itemized Shop Loss.'

"From then on the turn slip follows the ware all the way through the finishing operations, and as the finishing operations progress, and inspections are made, the losses are itemized and inserted on the back of the sheet. Finishing time also is posted to the turn slip, and this time is set up and compared with the standard as determined in our standard cost.

"After all finishing operations have been completed, the losses are summarized and brought forward to the front of the sheet. The number of pieces which are good is determined, delivery slips are made out to deliver the goods to the warehouse, and the turn slip is completed by a posting



KEEP CLEAN – MAKE NO ERASURES

TURN SLIP

MACBETH-EVANS GLASS COMPANY

DATE _____ 193

AMPOULE NO. _____ GLASS _____ PIECES TO STOCK _____

(UNDERSCORE WORDS WHICH APPLY)

IRON : PASTE : PRESS : MOULD : GERMAN : AMERICAN : SEMI GERMAN : MACHINE : AUTO SEMI-AUTO

SHOP NO. _____ BLOWER _____ SHOP _____ HRS. _____ GATHERERS _____

_____ FACTORY TANK POT NO. _____ LEER NO. _____

CHECK NUMBER | TIME: HOURS, MINUTES | RATE | AMOUNT

CUTTING AND STAMPING

SELECTING AND TESTING

SUMMARY OF LOSSES

(FOR DETAILED ACCOUNT SEE REVERSE SIDE OF SHEET)

DIRECT LOSS OF SHOP

REGISTERED _____

LEER COUNT _____

TOTAL SHOP LOSS _____

PIECES PAID FOR _____

CHIPPING

FINISHING LOSS

GRINDING AND REAMING

TOTAL FINISHING LOSS _____

PIECES PACKED _____

SENT TO _____ DEPT. _____

TOTAL REFINISH LOSS _____

REFINISHED WARE PACKED _____

REFINISHED WARE SENT TO _____ DEPT. _____

GRINDING

WASHING

TOTAL 1 AND 2 _____

TOTAL SHOP AND FINISHING LOSSES _____

PACKING

PACKER'S CHECK

NO. OF PKGS.	KIND OF PACKAGE: STANDARD	KIND OF PACKAGE: SPECIAL †	DOZ. PER PKG.	NO. PIECES TO STOCK: PACKED	NO. PIECES TO STOCK: LOOSE	DATE	SIGNED BY

† WHEN SPECIAL PACKING IS USED SPECIFY CONTAINER AND ALL INTERIOR PACKING ON SEPARATE SHEET AND ATTACH TO THIS TURN SLIP.

REFINISHED OPERATIONS ARE TO BE LISTED IN THIS COLUMN AND MARKED THUS *

at the bottom showing the number of packages, kind of package, and the date of delivery.

"The itemized losses then are posted to a summary card, which is very carefully scrutinized as to the itemized losses to aid us in controlling and reducing the loss."

The Materials and Equipment Division of the American Ceramic Society

THE Materials and Equipment Division of the American Ceramic Society is now a recognized Division and has been given a place along with the other Divisions of the American Ceramic Society. The object of this Division is to assist in advancing ceramic arts and sciences, which is the prime object of the parent Society.

Incidentally, art is described by Webster, in part, as "skill in performance acquired by special study or observation," and again "systematic application of knowledge or skill in effecting a desired result; also an occupation requiring such knowledge and skill." Science he describes as "accumlated and accepted knowledge systematized and formulated with reference to the discovery of general truths or operation of general laws." Broadly then, the objects of the Society are the accumulation and application of knowledge pertaining to ceramics.

The ultimate value of and justification for any science are the benefits it brings to man through practical application to meet a need, provide comfort and leisure. Leisure is a cultural necessity. The usefulness of ceramics is in the results of the application of scientific knowledge by technical personnel to provide commodities serving purposes of health, comfort, convenience, luxury, leisure, etc.

Quoting from an article appearing in the June, 1931, issue of the *Journal*, official publication of the American Ceramic Society,

it is stated that "the difference between pure and applied science is a difference only in attitude, viewpoint, or eventual objective. There is a very great difference, however, in difficulty. The worker in pure science is not particularly going anywhere. He is not being attracted irrevocably by an objective. He is being urged more or less by curiosity. In applied science, as it is being practiced today, one not only has to be pushed by his curiosity but has a definite objective ahead of him. If obstacles appear in the pathway he must get around them, whereas the pure scientist may digress into a by-way or stop altogether. Usually he is not being paid to reach objectives." Few members of the Society would admit that they are "not particularly going anywhere"; they are in every case "being paid to reach objectives."

The underlying purpose of all the Divisions is the general dissemination of knowledge and the application of knowledge so gained to practical uses. Interest is primarily in improvement in technique of manufacture at lower costs of ceramic products—more particularly in the class of production in which one is personally engaged—and in the science of ceramics as this increased knowledge may be applied to practical problems of industry. Representatives of both producers and consumers are not likely to ponder to any great length on hazy considerations in the realm of pure science but do try to improve themselves and increase their usefulness by the assimilation and co-ordination of the sciences and arts of ceramics.

It is true that abstract research is and must be pursued—the determination of characteristics of clays; the behavior of metals under conditions found in an enameling furnace; cause, development and elimination of defects in glass—but the aim of such research is the utilitarian one of increasing the fund of knowledge to avoid and overcome such pitfalls as beset commercial production, so that finished products of highest quality may be made with a minimum of defects and losses. Practically all such research work is endowed by *PRODUCTION* rather than an altruistic interest in the abstract; as it is dependent on production, so the return or benefit is reflected to the source in the form of greater efficiency. The relation between the scientific and the technical of the ceramic or other art may be likened to the distinction between functions of diagnosis and surgery. The diagnostician distinguishes a condition and indicates a corrective procedure, but the surgeon, by his ability in the mechanics of operation, provides results. It is through the coordination of the two types of ability that a desirable result is achieved; either is insufficient unless complemented by the other.

A substantial percentage of the membership of the Society is interested in the advancement of the ceramic arts and sciences through its capacity to provide the materials and mechanical appliances required. In keeping with the established policy of the Society, encouraging the grouping of members with common interests into Divisions, this group has properly organized itself into the Material and Equipment Division. A number of the Fellows of the Society are, or have been, affiliated with organizations rightfully to be included within the classification of this Division.

If a member is affiliated one day with an organization producing and merchandising a raw material or article or mechanical equipment and the next day associates himself with an organization producing finished ceramic products, his interest in and capacity for the advancement of ceramics have not been impaired, nor should there be any change in his status as a desirable unit of the Society.

The aim of ceramic production is the merchandising of finished ware. Such finished products may possess aesthetic value but they are actually manufactured only because of a commercial value in the markets to which they are distributed. Therefore any contribution directed toward the goal of providing desirable or necessary articles of ceramic ware should be looked upon with the same dignity and respect as any other contribution.

The change from the primitive practices followed in the making of ceramic products in ancient times to the modern and efficient practices followed today certainly are as much due to the availability of dependable materials and mechanical equipment as to the increase in the scientific knowledge of the use and handling of such articles. Improvements in materials and equipments have been the cause, and not the result, of much of the increase in ceramic progress.

Production and sale of the means of making ceramic products is as necessary to the advancement of ceramics as the production and sale of finished ceramic wares; producer and seller of a filter sack, a ton of clay, a recording instrument, suitable refractories, properly designed equipment, are exactly as essential a part of ceramics as the producer and seller of pottery, tile, glass, enamel, etc.

March 16, 1932.

V. V. KELSEY,
Consolidated Feldspar Corporation,
Trenton, N. J.

GLASTECHNISCHE TABELLEN. By Wilhelm Eitel, Marcello Pirani and Karl Scheel. 714 pages, 900 diagrams and illustrations. Julius Springer, Berlin, 1932. Price, unbound, 145 marks; bound 149.80 marks.

This vast compendium of technical tables on glass is like the Landolt-Börnstein Physikalisch-chemische Tabellen, it has been made possible through the subsidy of the Deutsche Glastechnische Gesellschaft, the editors named above and their associates.

It is divided into three parts. Section 1 covers equilibria in glass forming systems, conditions under which they may best function, the proportions of the components and their crystalline phases. It takes up the glass-forming oxides, borate systems, carbonate systems, phosphate systems and silicates. Space is then devoted to two, three and four, or more, component systems as well as to organic substances which may enter a glassy state. This section is replete with phase diagrams which indicate the particular substances possible under various conditions and the point at which eutectic mixtures result. The crystal forms which are obtained are generously illustrated. Section 1 covers the first 88 pages.

Section 2 is devoted to physical and chemical constants such as viscosity, surface tension, internal strain, tensile strength, softening point, specific gravity, coefficient of elasticity, compressibility, cohesion, hardness, refractoriness, porosity to gases, adsorption and evolution of gases, thermal expansion, specific heat, heat conductivity, dielectric constants, electrical capacity, electrical conductivity, sparking point, potential differences, magnetic susceptibility, crushing strength, photo elasticity, effect of electric fields on refraction, spectral transmission, ultra-violet transmission, infrared transmission, total light transmission, properties of light filters, dispersion data, chemical susceptibility with methods of testing and results, devitrification. 536 pages are covered by this section which not only contains numberless tables and diagrams but copious references to the literature covering every item discussed. Here, every glass has a key number which refers to some part of Section 3 of the publication.

Section 3 contains a systematic record of the chemical composition of the glasses covered in Section 2. These are the alkali silicates; the alkali-lime silicates, containing up to 1% of alumina; the alkali-lime-alumina silicates; the alkali silicates with those of calcium, magnesium, strontium, barium, iron, manganese and aluminum; the alkali-alkaline-earth-alumina-lead silicates; the alkali-alkaline-earth-boro silicates; glasses both clear and clouded containing the halogens and phosphorus; silica-free glasses like the borates, phosphates and arsenates; glassy organic substances. With each analysis there is not only a key number but a reference to pages in Sections 1 and 2, where the particular glasses are discussed as to their properties. Section 3 covers 83 pages.

This gigantic undertaking is priceless. The type is clear, the diagrams and illustrations are clean cut, the cross references are well ordered and the reviewer has thus far not found a single fault in the use of such references. Here is a compilation of data never before available to glass technologists and scientists in other fields who are interested in the properties of glass. It should prove indispensable to serious workers in the field. There is a good table of contents, but the index might be more complete.

The authors and their collaborators are certainly to be congratulated for having made a precious contribution. It is to be hoped that these tables may be translated into English and thus made available for those who are unable to use the German publication.

ALEXANDER SILVERMAN.

The American Leather Belting Association with the endorsement of the industry, has decided that for the greater protection of the consumers of leather belting, it should establish and sell this commodity by specifications of thickness instead of weight, thereby discarding the old weight terminology of "ounces per square foot."

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C., Price 10c each

PROCESS AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,848,097. 3/8/32. Daniel Adams, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 9/7/29.

PROCESS AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,848,102. 3/8/32. James C. Blair, Toledo, O. Assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 7/14/28.

PROCESS AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,848,111. 3/8/32. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 6/8/28.

METHOD AND APPARATUS FOR FORMING SHEET GLASS. U. S. 1,848,113. 3/8/32. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 10/20/28.

PROCESS AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,848,114. 3/8/32. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 8/30/29.

METHOD AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,848,115. 3/8/32. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 9/18/29.

PROCESS AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,848,116. 3/8/32. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 9/18/29.

PROCESS AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,848,153. 3/8/32. James C. Blair, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 6/22/28.

PROCESS AND APPARATUS FOR PRODUCING SHEETS OF GLASS. U. S. 1,848,112. 3/8/32. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 7/14/28.

METHOD AND APPARATUS FOR FORMING AND ANNEALING SHEET GLASS. U. S. 1,848,107. 3/8/32. Carroll Cone, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 9/18/29.

PROCESS AND APPARATUS FOR FORMING AND ANNEALING SHEET GLASS. U. S. 1,848,103. 3/8/32. James C. Blair, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 9/18/29.

PROCESS AND APPARATUS FOR FORMING AND ANNEALING SHEET GLASS. U. S. 1,848,117. 3/8/32. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 9/18/29.

PROCESS AND APPARATUS FOR THE MANUFACTURE OF SHEET GLASS. U. S. 1,848,154. 3/8/32. James C. Blair, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 9/18/29.

PROCESS AND APPARATUS FOR FORMING AND ANNEALING SHEET GLASS. U. S. 1,848,161. 3/8/32. Carroll Cone, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 9/18/29.

SOUNDPROOF AND HEAT INSULATING GLASS. U. S. 1,848,190. 3/8/32. Willard L. Morgan, Nutley, N. J., assignor to Libbey-Owens-Ford Glass Company. Filed 8/23/30.

PNEUMATIC GLASS FEEDER. U. S. 1,848 395. 3/8/32. Thomas Stenhouse, Washington, Pa., assignor to Hazel-Atlas Glass Company, Wheeling, W. Va. Filed 4/18/30.

GLASS BEVELING MACHINE. U. S. 1,848,470. 3/8/32. Rudolf Fohrenbach, Offenburg in Baden, Germany, assignor to Wolfgang Grethmann, New York, N. Y. Filed 1/15/29.

APPARATUS FOR STACKING GLASSWARE. U. S. 1,849,038. 3/8/32. Henry W. Ingle, Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. Filed 11/1/26.

GLASS FEEDER. U. S. 1,847,276. 3/1/32. Thomas Stenhouse. Washington, Pa., assignor to Hazel-Atlas Glass Company, Wheeling, W. Va. Filed 1/14/29.

GLASS APPARATUS. U. S. 1,847,156. 3/1/32. Jesse W. Wildermuth, Lancaster, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 2/6/29.

PROCESS AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,849,796. 3/15/32. Frank Fraser, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 5/31/30.

CONTINUOUS GLASS GRINDING AND POLISHING MACHINE. U. S. 1,849,980. 3/15/32. James Harris Griffin, St. Helens, England, assignor to Pilkington Brothers, Limited, Liverpool, England. Filed 3/14/31 and in Great Britain 3/20/30.

LAMINATED GLASS AND METHOD OF PREPARING THE SAME. U. S. 1,849,504. 3/15/32. William Henry Moss, Cumberland, Md., assignor to Celanese Corporation of America. Filed 3/13/29.

PROCESS OF GRINDING AND POLISHING GLASS PLATES. U. S. 1,850,946. 3/22/32. Lambert Von Reis, Herzogenrath, Germany, assignor to Societe Anonyme des Ateliers Heuze, Malevez et Simon Reunis, Auvelais, Belgium, and Pilkington Brothers Limited, St. Helens, Lancaster, England. Filed 6/20/27 and in Germany 8/4/26.

GLASS TRANSFER MECHANISM. U. S. 1,850,968. 3/22/32. William A. Morton, Dormont and Paul L. Geer, Pittsburgh, Pa., assignors to Amco, Incorporated, Pittsburgh, Pa. Filed 6/24/29.

DEVICE FOR USE IN CUTTING GLASS. U. S. 1,850,632. 3/22/32. George R. Kelly, Highland Park, Mich. Filed 9/29/30.

GLASS ARTICLE AND METHOD OF TREATING THE SAME. U. S. 1,850,537. 3/22/32. Wlodzimierz Maryland Daniewski, Kielce, Poland, assignor to Corning Glass Works, Corning, N. Y. Filed 12/22/28 and in France 3/5/28.

SHEET GLASS EDGING MACHINE. U. S. 1,850,465. 3/22/32. Henry O. Kranich, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 6/8/31.

GLASS ROLLING APPARATUS PARTICULARLY APPLICABLE TO THE PRODUCTION OF CONTINUOUS GLASS STRIP. U. S. 1,851,609. March 29, 1932. Frederic Barnes Waldron, Prescot, England, assignor to Pilkington Brothers Limited, Liverpool, England. Filed 12/18/30 and in Great Britain 12/28/29. In apparatus for rolling glass, a roller for forming the glass, yielding bearings for said forming roller, two co-axial auxiliary rollers having their axes parallel with that of the forming roller, a fixed bearing for each of said auxiliary rollers, and two collars, one on each of said rollers, located at a distance apart not less than one-half and not greater than two-thirds of the width of the glass being rolled, said collars being in rolling contact with the forming roller to determine the position of the latter in a direction perpendicular to the glass being rolled.

PROCESS AND MEANS FOR ROLLING GLASS. U. S. 1,851,804. March 29, 1932. Yvon Brancart, Ronquieres, Belgium. Filed 10/11/30 and in Belgium 10/18/29. In combination with a casting table, a convex roll for rolling glass on said table, said roll having a longitudinally curved outer surface, the radius of said longitudinal curvature being smaller at the ends than toward the middle of said roll.

PROCESS AND APPARATUS FOR ROLLING THICK PLATES OF GLASS. U. S. 1,851,803. March 29, 1932. Yvon Brancart, Ronquieres, Belgium. Filed 10/11/30, and in Belgium 10/18/29. In apparatus for rolling molten glass, the combination of a kidney-shaped receptacle, a substantially vertical partition extending axially under said receptacle, a pair of large rolls adapted to co-operate with one another, each of said rolls being adapted to receive glass supplied from said receptacle on one side of said partition, and two small rolls above said large rolls adapted each to co-operate with one of said large rolls.

APPARATUS FOR MAKING ROLLED GLASS STRIPS. U. S. 1,851,634. March 29, 1932. Ernest Bristow Le Mare, St. Helens, England, assignor to Pilkington Brothers, Limited, Liverpool, England. Filed 7/17/31 and in Great Britain 7/31/30. Apparatus for rolling glass comprising a rolling apparatus, a first bed variable in position with the rolling apparatus, a lehr with roller bed, a third fixed bed adapted to lead the rolled glass to the said roller bed, a second bed pivoted near the back end of the third bed and means for turning the second bed on its pivot so as to remove it substantially from the space between the first and third beds.

The Glass World and What It Is Doing

News of the Industry

Borax and Boric Acid Prices Reduced

Announcement has been made by the American Potash and Chemical Corporation of a substantial reduction in prices of their standard grades of borax and boric acid. The revised price list follows:

	Single Car Lots (delivered)	*Less Car Lots (ton lots) (ex warehouse)*
BORAX ($Na_2B_4O_7.10H_2O$)		
Refined granular —bags lb.	.02	.02¼
Refined granular —bbls. lb.	.02½	.02¾
Refined powdered—bags lb.	.02¼	.02½
Refined powdered—bbls. lb.	.02¾	.03
BORIC ACID (H_3BO_3)		
Refined granular —bags lb.	.04¼	.04½
Refined granular —bbls. lb.	.04¾	.05
Refined powdered—bags lb.	.04½	.04¾
Refined powdered—bbls. lb.	.05	.05¼

The announcement of the company, one of the largest producers of borax and boric acid, is of great interest to the glass industry, not only because both borax and boric acid are essential batch ingredients for the special heat resisting borosilicate glasses, but also because, during the past few years, the addition of borax (60 to 100 lbs. per ton sand) to the more common soda-lime-silica batches has become standard practice in a large number of glass factories.

The majority of well-known bottle manufacturers in the United States and Canada are now using borax in appreciable quantities. Likewise, manufacturers of pressed and blownware are consuming large tonnages.

Borax greatly facilitates the melting of glass batch and its use increases the capacity of the furnace without any increase in melting temperature or decrease in furnace life. Obviously this increase in capacity with no greater heat imput, results in lower melting costs per ton of glass. Comparison of melting capacity with and without borax in the batch indicates that increases of at least 25 per cent are not at all uncommon where borax is employed and occasionally these increases exceed 50 per cent. In cases where increased capacity is not needed, the borax addition makes it possible to maintain the former production of seed free glass while melting at lower temperatures.

Contrary to the former beliefs of some glass engineers, the addition of this material to the ordinary soda-lime-silica glasses does not impart corrosive properties to the batch which might hasten the destruction of the pots or tank blocks. Such a speculation no doubt finds origin in the experience encountered with the borosilicate glasses which, being high in silica content, require much higher melting temperatures and naturally would have a deleterious effect on the tank or pot in which they are melted. For reasons previously stated, the borax addition to the common soda-lime-silica glasses has a decided tendency to increase the total tonnage capacity of the furnace, either through the production of more seed-free glass at normal operating temperatures, or through the production of normal tonnage at lower operating temperatures.

The presence of B_2O_3 in glassware materially decreases its tendency to corrode or bloom. At the same time, it increases the brilliance and clarity of the finished product. Mechanical strength as measured by both hydrostatic and impact forces is also increased. Better thermal properties are characteristic of B_2O_3 containing glasses although reasonably large amounts of borax must be added to gain a marked effect.

Considering the economy and improved quality which have been realized through the use of borax at former prices, the establishment of lower prices for this material will undoubtedly stimulate even wider use in the glass industry.

A bill, S. 1200, to establish a commission to be known as a Commission on a National Museum of Engineering and Industry was introduced recently by Senator Copeland of New York.

January and February Plate Glass Production

The total production of polished plate glass by the member companies of the Plate Glass Manufacturers of America for the month of January, 1932, was 5,499,611 sq. ft. as compared to 5,640,708 sq. ft. produced by the same companies in the preceding month, December, 1931, and 6,197,712 sq. ft. produced by the Association members in the corresponding month last year, January, 1931. The production for the month of February, 1932, was 6,426,905 sq. ft., and 7,645,693 sq. ft. produced by the Association members in the corresponding month last year, February, 1931.

Tariff Investigations on Fluorspar and Gauge Glass

An investigation of the differences in costs of production of fluorspar and other facts and conditions enumerated in section 336 of the Tariff Act of 1930 has been ordered by the United States Tariff Commission at a date to be posted for thirty days in the office of the Commission in Washington.

The report of the United States Tariff Commission on the cost of production in gauge glass tubes, submitted to President Hoover on November 17, 1931, is now available as report No. 36, from the Superintendent of Documents, Washington, D. C.

Irving Langmuir Honored

Irving Langmuir, research chemist and physicist and associate director of the Research Laboratories of the General Electric Company, Schenectady, has been awarded the *Popular Science Monthly* award of $10,000 for notable scientific achievement. Among Dr. Langmuir's notable contributions to pure and applied science are his inventions of the nitrogen-filled incandescent electric light bulb and the atomic-hydrogen welding art.

Owens-Illinois Earnings

Net earnings of the Owens-Illinois Glass Company and subsidiaries, as announced by President Wm. E. Levis on February 15, for the year 1931 amounted to $2,744,181, as compared with $2,738,540 earned in 1930. In arriving at these earnings, deductions have been made for interest on the debentures, depreciation, repairs, Federal taxes, bad accounts and contingencies. U. S. Government and Federal Land Bank Bonds have been reduced to market values at December 31, 1931. These net earnings are equivalent, after providing for the full yearly dividend on the preferred stock, to $2.45 per share on the 922,173 common shares outstanding at the close of the year 1931. During the past year the company retired out of surplus cash funds, $2,800,000 of its 5% ten-year debentures. This leaves $2,000,000 of these debentures outstanding out of the original $5,000,000 issue. The company's detailed earnings and asset figures will be ready for publication some time in March.

Amber Glass Protects U. S. Constitution

An item of current news that will attract the attention of those interested in novel uses for glass concerns the placing on exhibition in the Congressional Library at Washington of the original copy of the Constitution of the United States and the Declaration of Independence, where these priceless documents, exposed to view in a case, are covered with amber-colored glass to prevent their fading.

Society of Glass Technology

An announcement was recently made by the Council of names of members of the Society of Glass Technology who have been nominated for offices and for election at the 15th annual meeting, April 20, 1932, as follows: President, Edward Meigh; vice-presidents, S. English and E. Jobling-Purser; ordinary members of council, Milton Asquith, Albyn Bunce, Arnold Cousen, A. E. Hill and J. B. Murgatroyd; Hon. treasurers, B. P. Dudding; American, F. C. Flint; Hon. secretary, Prof. W. E. S. Turner; auditors to be nominated at the meeting.

New Department of Glass Technology at Alfred

Reports are current that Alfred University at Alfred, N. Y., will establish a Department of Glass Technology in connection with the present Ceramic College.

New High Temperature Cement on Market

The Charles Taylor Sons Company, Cincinnati, O., manufacturers of firebrick, recently put on the market a new high temperature cement known as P.B. Sillimanite Air Setting Cement. A booklet on this material will be sent to any reader on request.

The Dominion Glass Company, Montreal, Quebec, are reported as having increased their factory force to 600 employes.

The first lost-time accident to occur in 314 days at the Creighton plant of the Pittsburgh Plate Glass Company on March 5 filled the organization with determination to start at once to break that record.

The Corhart Refractories Company, Louisville, Ky., announces that the Emsco Refractories Company of Los Angeles now represents them as agents for the West Coast territory of the United States.

American Ceramic Society 1933 Meeting. A tentative program for the annual meeting of the American Ceramic Society, to be held in the Hotel William Penn, Pittsburgh, Pa., during the week of February 12, 1933.

F. W. Dodge Corporation's release Monday, March 14, 1932, showed construction awards in February almost 5% in advance over the January figures. The total for February divided among the four major construction classes amounted to $89,045,800.

The Toledo Engineering Company, Toledo, Ohio, report that the glass plant at Olean, New York, destroyed some time ago by fire, is now in operation, the furnace having been designed and re-constructed for a luminous method by firing and combustion control.

The report of the United States Tariff Commission on the cost of production in gauge glass tubes, submitted to President Hoover on November 17, 1931, is now available as report No. 36, second series, and may be obtained from the Superintendent of Documents, Washington, D. C., at 5 cents per copy.

The Owens-Illinois Glass Company, through President W. E. Levis recently announced the purchase through its California subsidiary, Owens-Illinois Glass, Ltd., of the bottle manufacturing plants of Illinois-Pacific Coast Company at San Francisco and Los Angeles. The price paid was $5,625,000.

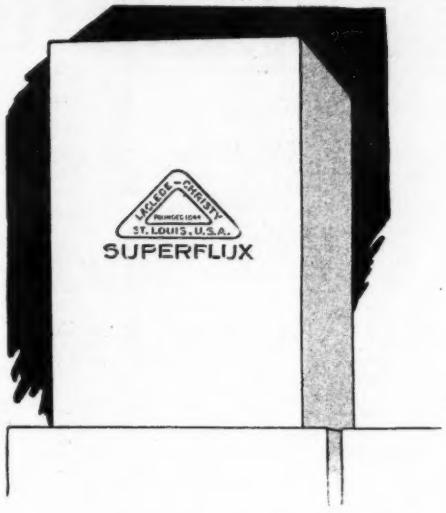
Libbey-Owens-Ford Glass Company in their report for the year ended December 31, 1931, showed a net loss of $1,098,195 after deducting depreciation, interest, provision for possible loss on claims against banks in liquidation and provision to reduce securities to market value. During the previous year the company reported a net profit of $1,419,303. The company has changed its fiscal year to end December 31 instead of December 30.

National survey of fuel oil distribution, 1930. United States Bureau of Mines report, a 32-page pamphlet describing and charting gas and fuel oil deliveries during 1930 throughout the entire country. Information is given on railroad deliveries, fuel oil consumed by locomotives, gas and electric power plants, oil consumption by manufactured gas industry, fuels used by public utilities, oil consumed for the heating of buildings and for domestic heating, shipments to principal countries. The national distribution of gas oil and fuel oil in 1926 to 1930, in barrels of 42 gallons each, shows in 1930 a distribution among ceramic industries of 1,989,547 barrels.

David W. Baird

David W. Baird, retired glass man, died at the age of eighty, Friday, March 4, at his home in Wheeling, W. Va. For a considerable period and until nine years ago he was manager of the Eagle Glass Company, Wellsburg, West Virginia.

Performance *talks*



"Over 24 Months' Constant Service!"

The Greensburg Glass Works, Greensburg, Pa., write: "We have used Laclede-Christy SUPERFLUX Blocks in our continuous tanks for quite a few years. Our No. 2 tank to date has been in constant operation, producing quality glass at better than rated capacity for over 24 months. And as yet we are not planning to repair this unit."

Plant conditions and practices may vary, but whatever *yours* are, you can be absolutely sure that Superflux Blocks will give you the very maximum of service. This also applies to Buckeye Blocks, now made by Laclede-Christy.

Let us fill an order for you right now—we can deliver on *quality, service, price.*

LACLEDE-CHRISTY, ST. LOUIS, U. S. A.

F2

SUPERFLUX BLOCKS

A LACLEDE-CHRISTY PRODUCT

Readers' Wants and Offers, Inquiries Received, What the World Wants—Page 9

Current Prices of Glass-Making Materials

March 22, 1932

Quotations furnished by various producers, manufacturers and dealers.

Acid		Carlots	Less Carlots
Citric (dom.)	lb.	..	.33½
Hydrochloric (HCl) 20° tanks, per 100 lb		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	.10	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	..
Sulphuric (H_2SO_4) 66° tank cars	tor	16.50	
Tartaric	lb.	..	.21½
Alcohol, denatured	gal.	..	..
Aluminum hydrate ($Al(OH)_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb.	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.15½
Ammonia water (NH_4OH) 26° drums	lb.		
Antimony, metallic (Sb)	lb.	.02½	.02¾
Antimony oxide (Sb_2O_3)	lb.	..	.09¾
Antimony sulphide (Sb_2S_3)	lb	..	.08½
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.14 .04½
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	47.00	..
90% through 100 mesh	ton	44.00	
Barium hydrate ($Ba(OH)_2$)	lb.	..	.05¼
Barium mixture, glassmaker's, f.o.b. St. Louis	ton	25.00	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	..	.07¼
Barium selenite ($BaSeO_3$)	lb.	..	..
Barium sulphate, in bags	ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point,	ton	15.00-16.00	18.00
Bone ash	carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$)	lb.		.02¼-.02¾
Granulated	lb.	.02-.02½	.02¼-.02¾
Powdered	lb.	.02¼-.02¾	..
Boric acid (H_3BO_3)	lb.	.04¼-.05¼	..
Cadmium sulphide (CdS)—			
Red	lb.	..	.65-.90
Orange	lb.	..	.60-1.10
Yellow	lb.	..	1.30-1.50
Chromium oxide (Cr_2O_3)	lb.	..	.20
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	1.35
In 10 lb. tins	lb.	..	1.45
Copper oxide			
Red (Cu_2O)	lb.	..	.25
Black (CuO)	lb	..	.17-.19
Black prepared	lb	..	.22
Cryolite ($Na_3Al F_6$) Natural Greenland Kryolith)	lb	.09	.09¼
Synthetic (Artificial)	lb.	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb		..	1.15-1.20
*Feldspar—			
100 mesh	ton	11.50-17.50	12.00-18.00
80 mesh	ton	11.00-11.50	13.00
40 mesh	ton	10.75-11.00	12.00
20 mesh	ton	9.50- 9.75	10.00
Fluorspar (CaF_2) domestic, ground, 96-98% (max SiO_2 2½%)			
Bulk, carloads, f.o.b. mines	tor	30.00	..
In bags or barrels	tor	34.00	39.00
Imported	tor	30.00-31.00	33.00-37.00
Formaldehyde	lb	..	.07
Graphite (C)	lb	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb	..	.0425
Black (FeO)	lb	.04½	..
Kaolin (f.o.b. mine)	tor	8.00-9.00	..
English, lump, f.o.b. New York	tor	14.50-25.00	24.50-30.00

*Spot Shipments.

Kryolith (see Cryolite)		Carlots	Less Carlots
Lead chromate ($PbCrO_4$)	lb.		30
Lead oxide (Pb_3O_4) (red lead)	lb.	.0565	.0675
Litharge (PbO)	lb.	.0465	.0575
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	5.50	..
Burnt (CaO) ground, in bulk	ton	5.00	..
Burnt, ground, in paper sacks	ton	7.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15	..
Limestone ($CaCO_3$)		1.50-2.50	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb	.06	.07
light (in bbls.)	lb	..	.23
extra light (in bbls.)	lb	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.10
Manganese 85% (MnO_2)	lb.	.03	.03
Nickel oxide (Ni_2O_3), black— for nickel content	lb	..	.35
Nickel monoxide (NiO), green— for nickel content	lb	..	.35
Plaster of Paris, bags	ton	21.00	23.00-29.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.09	.09¼
Ground	lb.	.11	12
Potassium carbonate—94-96%	lb.	.0555	.0555
Calcined (K_2CO_3) 96-98%	lb.	.06¼	.07
Hydrated 80-85%	lb.	.05¾	.06¼
Potassium chromate (K_2CrO_4)	lb.	..	.25
Potassium hydrate (KOH) (caustic potash)	lb	.07½	.08
Potassium nitrate (KNO_3) (gran.)	lb.	..	.06-.06¼
Potassium permanganate ($KMnO_4$)	lb.	.16	.17
Powdered blue	lb.	..	.17½
Rochelle salts, bbls.	lb.	..	.16
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb.	..	1.70
Silver nitrate ($AgNO_3$) (100 oz.) per oz		..	.23¾
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.05	..
In barrels	Per 100 lb.	1.38	1.90-2.13
In bags	Per 100 lb.	1.17½	1.72½-1.92½
Spot orders.. .025 per 100 lbs. higher		..	..
Sodium bichromate ($Na_2Cr_2O_7$)	lb	.07	.07½
Sodium hydrate (NaOH) (caustic soda) Solid	Per 100 lb	2.50	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	..	..
95 per cent.	Per 100 lb.	1.67-177	1.72-1.82
Sodium selenite (Na_2SeO_3)	lb.	..	2.00
Sodium fluosilicate (Na_2SiF_6)	lb.	.05½	.06
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.50-1.55
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb	3.45	3.80-4.00
Flowers, in bags	Per 100 lb	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb	.37½	.39
Tin oxide (SnO_2) in bbls.	lb	.28	.29½
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black	lb	..	2.75
Yellow	lb	..	1.50
Zinc oxide (ZnO)	lb.	.08½	12
American process. Bags	lb	.06	.06½
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)		.03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to February 24, 1932

	January 1931 Quantity	January 1931 Value	January 1932 Quantity	January 1932 Value	Six Months Ending December 1930 Quantity	Six Months Ending December 1930 Value	Six Months Ending December 1931 Quantity	Six Months Ending December 1931 Value
Glass and glass products (Total)	.....	$647,515	.....	$372.659	.....	$4,337,024	.....	$2,899,232
Plate and window glass—								
Window glass, common, box 50 sq. ft.	813	4,375	182	874	5,383	29,567	4,194	17,856
Plate glass, unsilvered, sq. ft.	374,036	106.224	367,181	91,645	1,570,801	494,660	1,439,415	417,292
Other window and plate glass lbs.	405,327	32,543	185,919	20,811	2,576,375	194,368	1,151,963	110,561
Glass containers (bottles, vials and jars)	.....	210,155	.....	79,722	.....	1,485,754	.....	971,924
Table glassware, plain	.....	67,906	.....	32,090	.....	559,642	.....	388.919
Table and other glassware, cut or engraved	.....	3,449	.....	5,261	.....	47,087	.....	34,979
Lamp chimneys and lantern globes lbs.	.....	13,324	.....	4,424	.....	96,328	.....	27,817
Globes and shades for lighting fixtures lbs.	.....	45,219	.....	16,055	.....	253,502	.....	175,154
Chemical glassware lbs.	14,786	15,225	8,892	7,890	148,960	118,200	83,025	75,652
Electrical glassware, except for lighting lbs.	106,047	10,764	145,077	6,049	781,838	65,434	426,206	27.060
Other glassware	.....	138,331	.....	107,838	.....	992,482	.....	652,018

IMPORTS

Corrected to February 24, 1932

Glass and glass products	.....	$495,209	.....	$326,826	.....	$4,256,948	.....	$3,392,047
Cylinder, crown, and sheet—								
Plain dut. lb.	777,960	32,720	157,364	5,919	3,857,393	148,934	3,297,578	122,279
Bent, beveled, colored, etc. dut. lb.	137,702	20,506	86.817	14,381	1,396,417	146,147	701,814	114,208
Plate glass dut. sq. ft.	390,931	100,384	264,942	45,380	2,687,111	572,388	2,242,121	386,568
Glass mirrors	188	383	430	503	427	1,048	1,116	3,220
Rolled, cylinder, crown, and sheet glass, ground, obscured, bent, beveled, colored, etc.	.....	4,182	.....	28,908	.....	26,734	.....	85,333
Laminated glass and manufactures, and plated glass	.....	458	.....	2,698	.....	11,881	.....	5,807
Bottles, vials, jars, and other containers	.....	44,579	.....	15,124	.....	438,994	.....	287,078
Scientific articles and utensils dut.	.....	30,718	.....	24,804	.....	204,288	.....	189,794
Tubes and rods dut.	.....	6,620	.....	5,637	.....	48,961	.....	66,349
Illuminating articles dut.	.....	40,841	.....	21,164	.....	275,136	.....	180,725
Blown glass articles—					.....	.....	5,984,042	49,634
Bulbs for electric lamps, without filament dut.	1,479,908	13,440	927,043	7,431				
Other blown glass articles dut.	.....	123.587	.....	92.842	.....	.....	.....	1,334,410
Pressed glass articles	.....	9.604	.....	12,649	.....	122.550	.....	79,659
Other glassware	.....	67,187	.....	49,386	.....	549,447	.....	486,983